WESTERN GAS

November 1931

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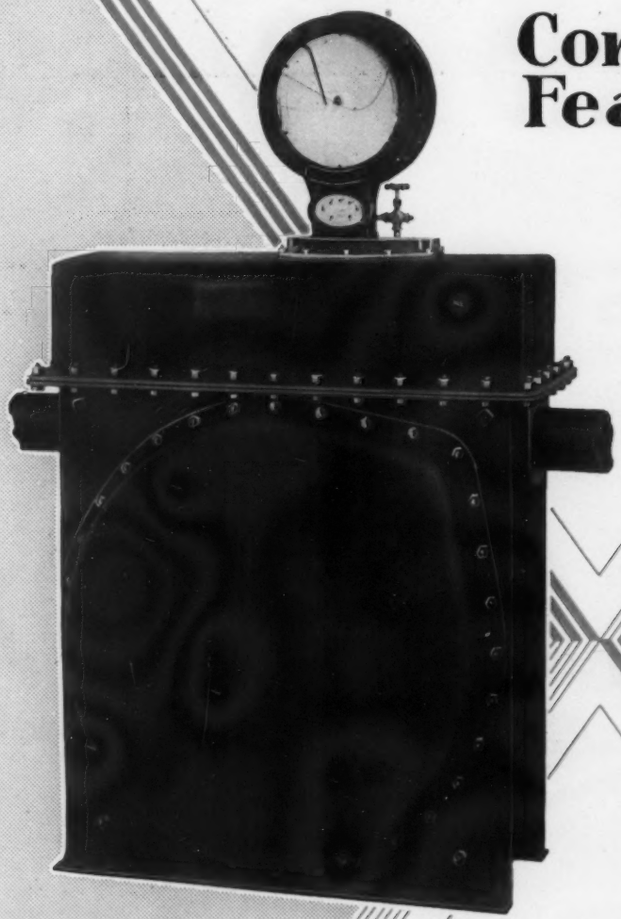

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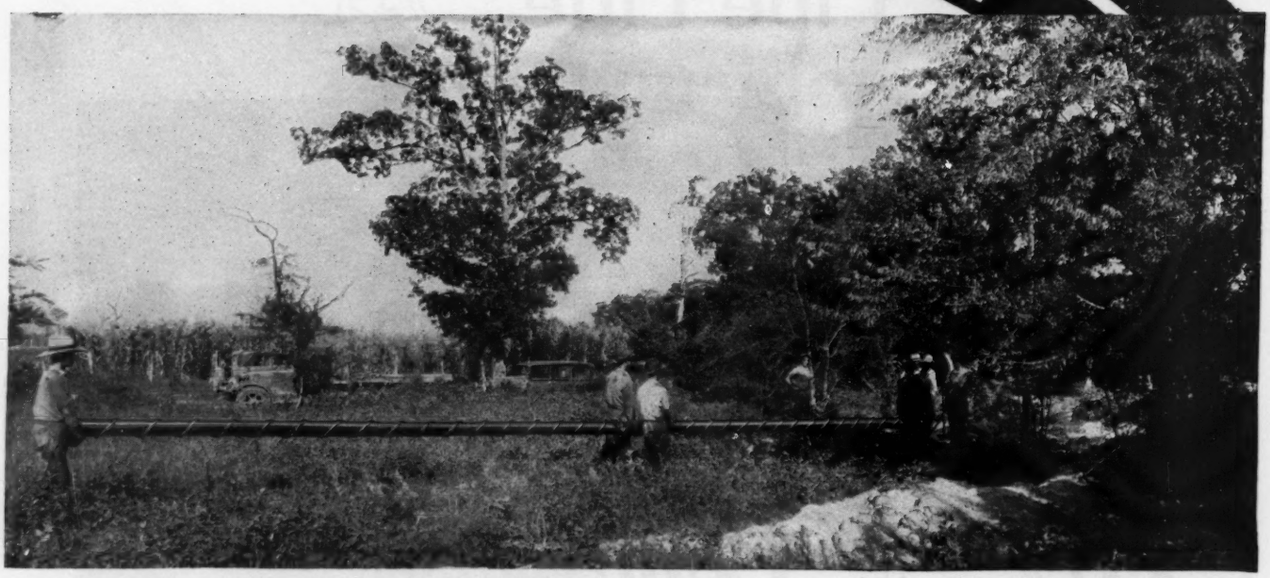
Means $$$ Saved



Laying a Naylor SPIRALWELD Pipe oil trunk line at Kinta, Oklahoma.

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HANDLING costs are a big item! They affect budgets, and increase total pipe line costs. Yet, handling costs can be reduced as many major oil and gas companies have proved by using *light weight* Naylor SPIRALWELD Pipe.

Naylor SPIRALWELD Pipe is made with an electrically welded spiral lock-seam truss which provides maximum structural strength with *minimum weight.* Compared with standard weight wrought pipe, Naylor SPIRALWELD Pipe weighs one half as much—yet, because of the added strength provided by the exclusive Naylor truss, it is being successfully used for the same pressures.

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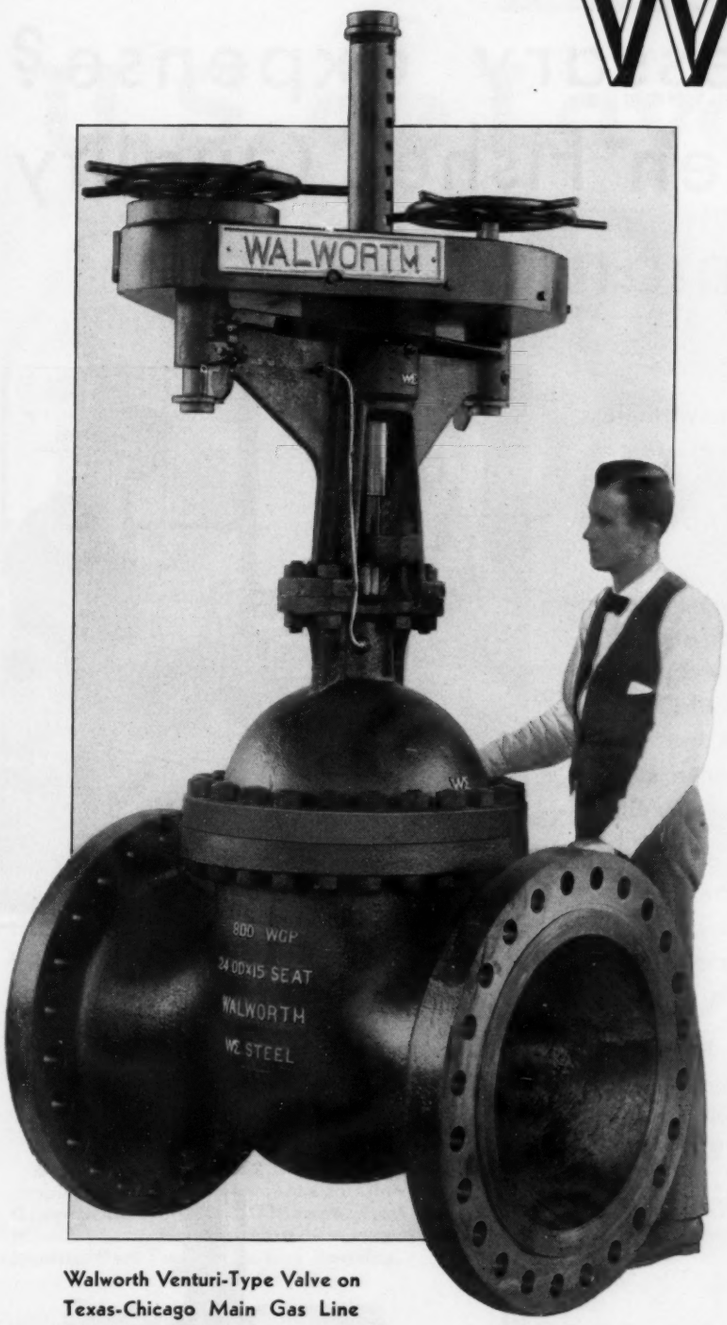

Walworth Venturi-Type Valve on Texas-Chicago Main Gas Line

The latest in Pipe Line Valves

This illustration shows the main line valve selected by The Continental Construction Corporation for The Natural Gas Company of America's 960-mile, 24″ O. D., 800-pound G.W.P. line from Texas to Chicago.

Outstanding features of this valve are:—

1. Venturi construction—port diameter at the seat being equivalent to a 16″ valve.
2. Walworth Sigma Steel body, bonnet and yoke with Stainless Steel stem and disc and Nitralloy seat rings.
3. Low and high speed gearing, tiller type hand-wheels, double, babbitted bearings, ball-bearing yoke, lantern type stuffing box, all with alemite lubrication, to bring the pull required to seat and unseat the disc within the capacity of one man.
4. Telescoping brass tubing to prevent dirt working into the stuffing box when the valve is buried.
5. Glass lined stem cover to permit operator to judge position of disc.

We feel that we have due cause to be proud of the Walworth engineers who designed these valves and of the foundry men and machinists by whose unsurpassed workmanship they were built.

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"The testing is also done at the specified operating pressure and temperature. A valve that is tight at room temperature is not necessarily so when you get it in a hot line.

"There are many operations that others might regard as 'unnecessary expense' but that we know are good reasons why you have never had trouble with Fisher Specialties."

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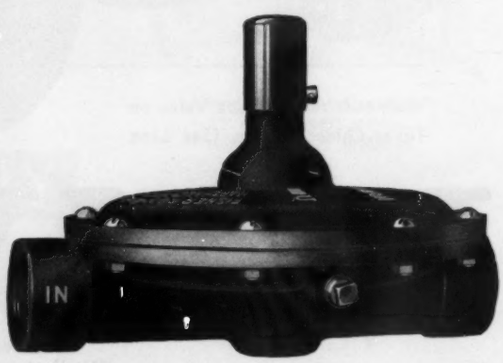
While the operation illustrated above and described at the left applies primarily to valves that control the flow of steam and other fluids at elevated temperatures, it is characteristic of the care that is exercised in the building of all Fisher Specialties.



The Fisher Type 725 House Service Regulator reduces high initial gas pressures (1 to 300 lbs.) to inches of water. It has distinctive features that make it more sensitive, while its extreme simplicity and rugged construction assure trouble-free operation and long life. This is not a "stock" regulator . . . it is "custom-built" to suit the specific operating pressures and the natural gas, manufactured gas, or propane, etc., for which it was ordered. Write for a copy of Circular No. 805.

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The deLavaud Handbook gives complete details and specifications. For free copy address United States Pipe and Foundry Co., Burlington, N. J.

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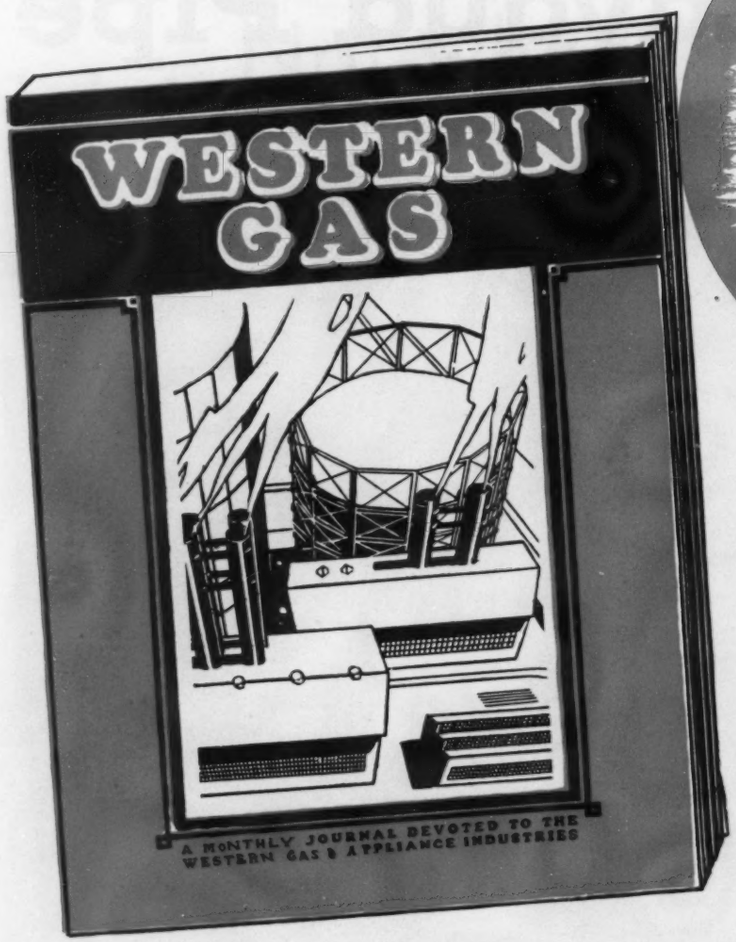

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One reason for the continuous leadership of WESTERN GAS is that it offers the most complete coverage of the Natural Gas and Butane-Propane industries. This is the section of the gas industry where the big developments are in progress.

3320 miles of new natural gas transmission lines have been announced. Construction to start during the next six months. *Detailed list of these projects will be sent upon request.*

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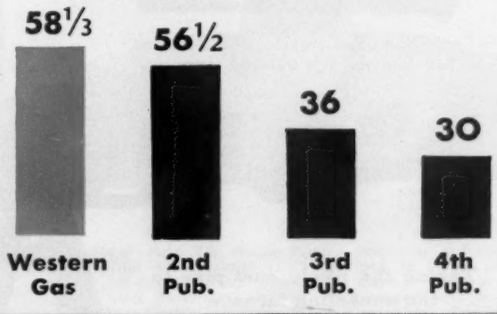

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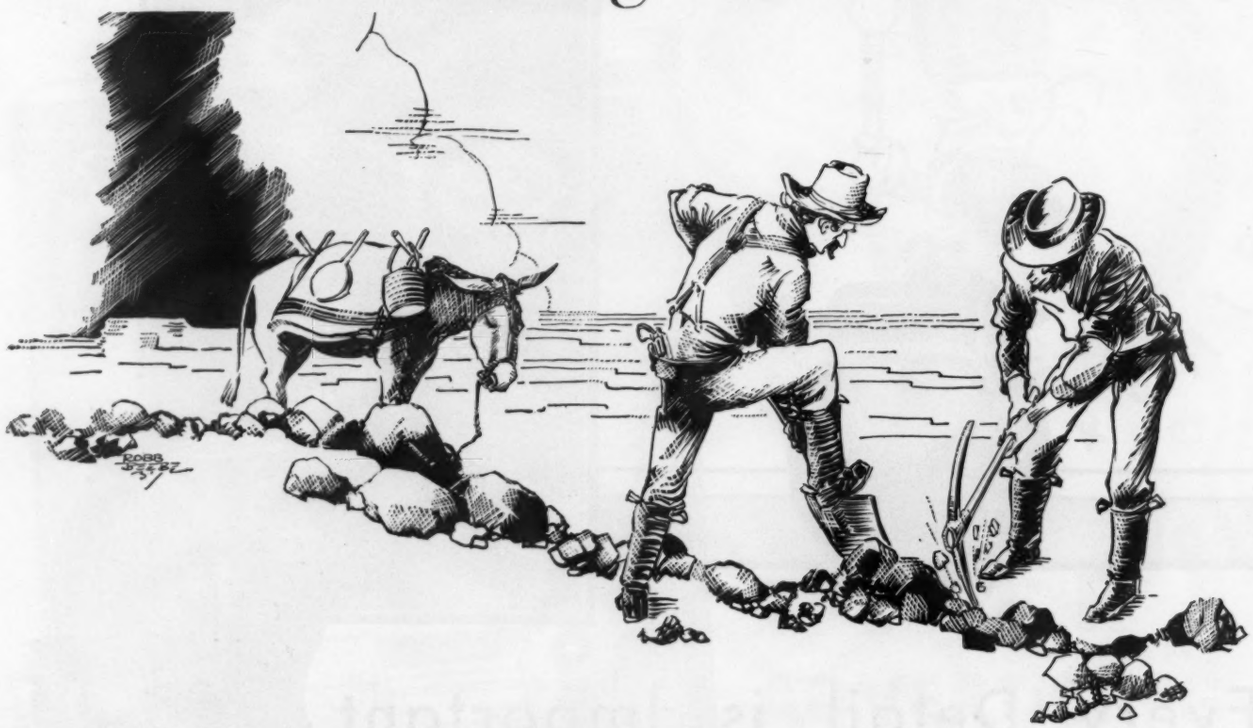
70-year-old Cast Iron Gas Mains are still serving San Francisco



IN 1861 San Francisco laid a cast iron gas main that is still in service. In that day the canyons and arroyos still resounded to the shovel and pick of the placer miner. But nearly thirty years earlier Baltimore, Philadelphia and Louisville had installed cast iron gas mains which are still serving. A survey of 44 leading cities reveals that in over 70 per cent. the original cast iron mains are still on the job. The fact that it is not uncommon to find 70 to 100-year-old cast iron gas mains rendering satisfactory service under the radically changed conditions of today is striking evidence of cast iron's durability and economy.

That those sturdy old mains are of remarkable quality must be conceded, yet the cast iron pipe available to the gas engineer today is even higher and more uniform in quality. In common with most industries and engineering practice, the cast iron pressure pipe industry has progressed with the years. Today cast iron pipe is manufactured under scientific metallurgical control and is tested for standards and uniformity by devices undreamed of three generations ago.

Modern cast iron pipe with efficient mechanical joints for high pressure distribution continues to meet the needs of the gas industry as it has for a century. For further information, address The Cast Iron Pipe Research Association, Thomas F. Wolfe, Research Engineer, 309 Peoples Gas Building, Chicago, Ill.

Efficient mechanical joints for cast iron gas mains are now in use and obtainable for high-pressure gas distribution.

Cast iron pipe bearing the "Q-check" trademark is obtainable from the following leading pipe founders: Alabama Pipe Company, Anniston, Ala.; American Cast Iron Pipe Company, Birmingham, Ala.; James B. Clow & Sons, 219 N. Talman Avenue, Chicago, Ill.; Donaldson Iron Company, Emaus, Pa.; Glamorgan Pipe and Foundry Company, Lynchburg, Va.; Lynchburg Foundry Company, Lynchburg, Va.; National Cast Iron Pipe Company, Birmingham, Ala.; United States Pipe and Foundry Company, Burlington, N. J.; Warren Foundry and Pipe Corporation, 11 Broadway, New York.

Reg. Trade Mark

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CAST IRON PIPE

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AMERICAN PROVERS

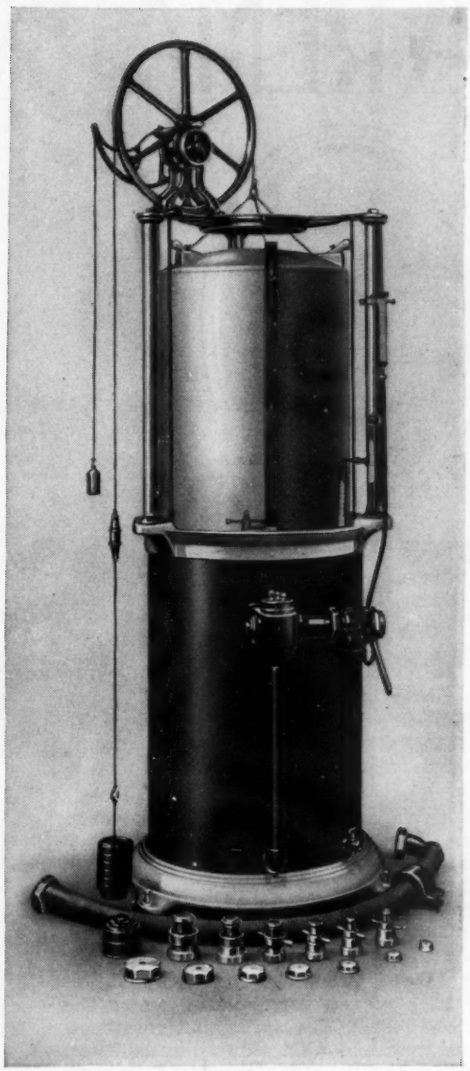
with OVER TWICE the former capacity

THE new American Provers — five foot, and ten foot — afford more than twice the capacity of the former type.

These improved models obviously enable larger meters to be proved at a rate equal to or in excess of rated capacities. Furthermore, advanced designing has greatly reduced the pressure loss at the meter inlet — an important improvement.

The new features include: (1) An increase in the airway diameter from the interior of the bell to the free end of the hose. (2) A larger dry well, hose and connection to conform to the increased area of the airway. (3) A handy gate valve. After a 2 years' exacting test in our own proving rooms this replaces the cock formerly used.

D. McDonald and Co. factory of American Meter Company, Headquarters for Apparatus, Albany, N. Y.



No.	Size	Capacity per hr. at 1½" pressure	
		FORMER TYPE	NEW TYPE
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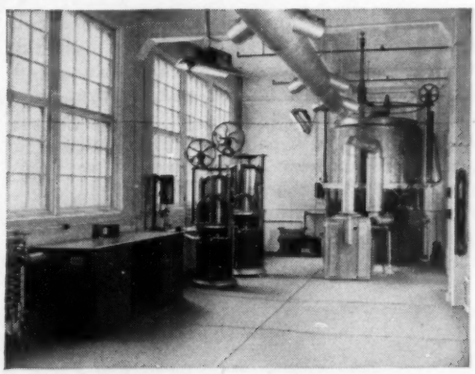
AL-14	10 ft.	1800 cu. ft.	5000 cu. ft.



Albany Research Laboratory of American Meter Company, specializing in low pressure measurement.

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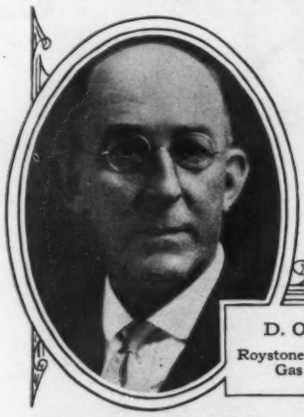


D. O'LEARY, *Chief Engineer*
Roystone Pumping Station, Pennsylvania Gas Company, Ludlow, Penna.

"THIS valve has been in continuous service since we received it three years ago and up to now has never had any replacing or repairing done on it.

"This is certainly a remarkable record for a compressor valve."

TRANSIT COMPRESSOR VALVE

THE illustration at the right shows the TRANSIT Ring Plate Gas Compressor valve disassembled after three years of operation.

Both valve plates and seats show some wear. The seats were purposely made very narrow, their width being easily seen in the illustration. Wear on the valve guides is very slight, not more than 004" or 005" on diameter

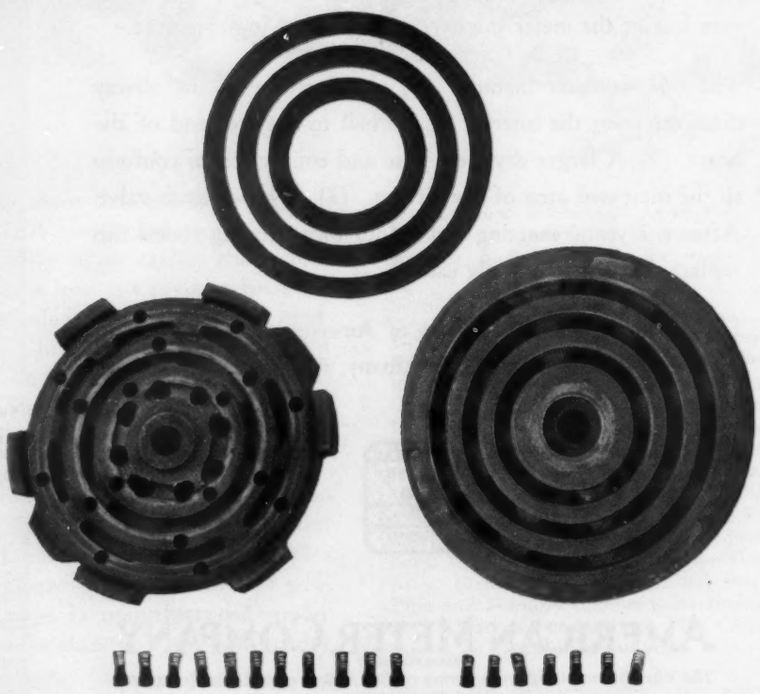
Valve plates were in constant slow rotation. This is proved by the high polish on the back of the valve plates, where the buttons rested. The spring buttons themselves were somewhat reduced in diameter, and they also showed wear where they came in contact with the valve guard.

Eleven of the eighteen springs showed no perceptible wear. The other seven showed wear, and had lost a coil or two. All springs, however, were sufficiently strong to exert force on the valve plates. In other words the valve was functioning perfectly when removed.

From appearances, we believe the valve would have operated for at least another year.

We manufacture a complete line of gas engine gas compressors. Of course, all are equipped with these new type valves.

We will also equip new or used compressors of any make with valve service of this type.



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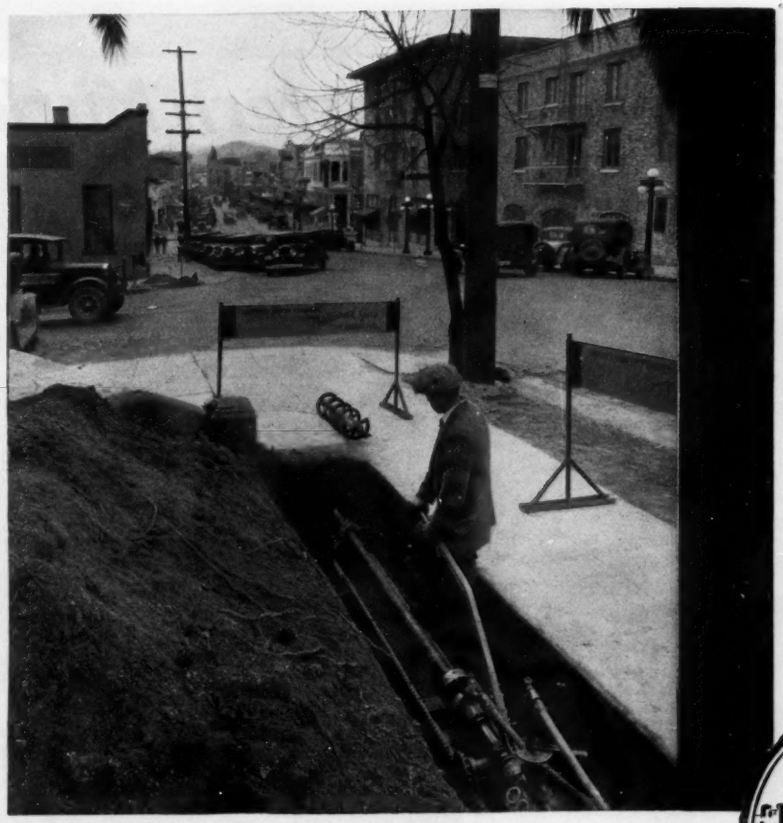
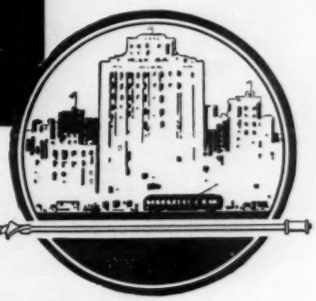


Photograph shows the Hydrauger running a bore under a busy street. Traffic goes on as usual and no pavement cutting is required.



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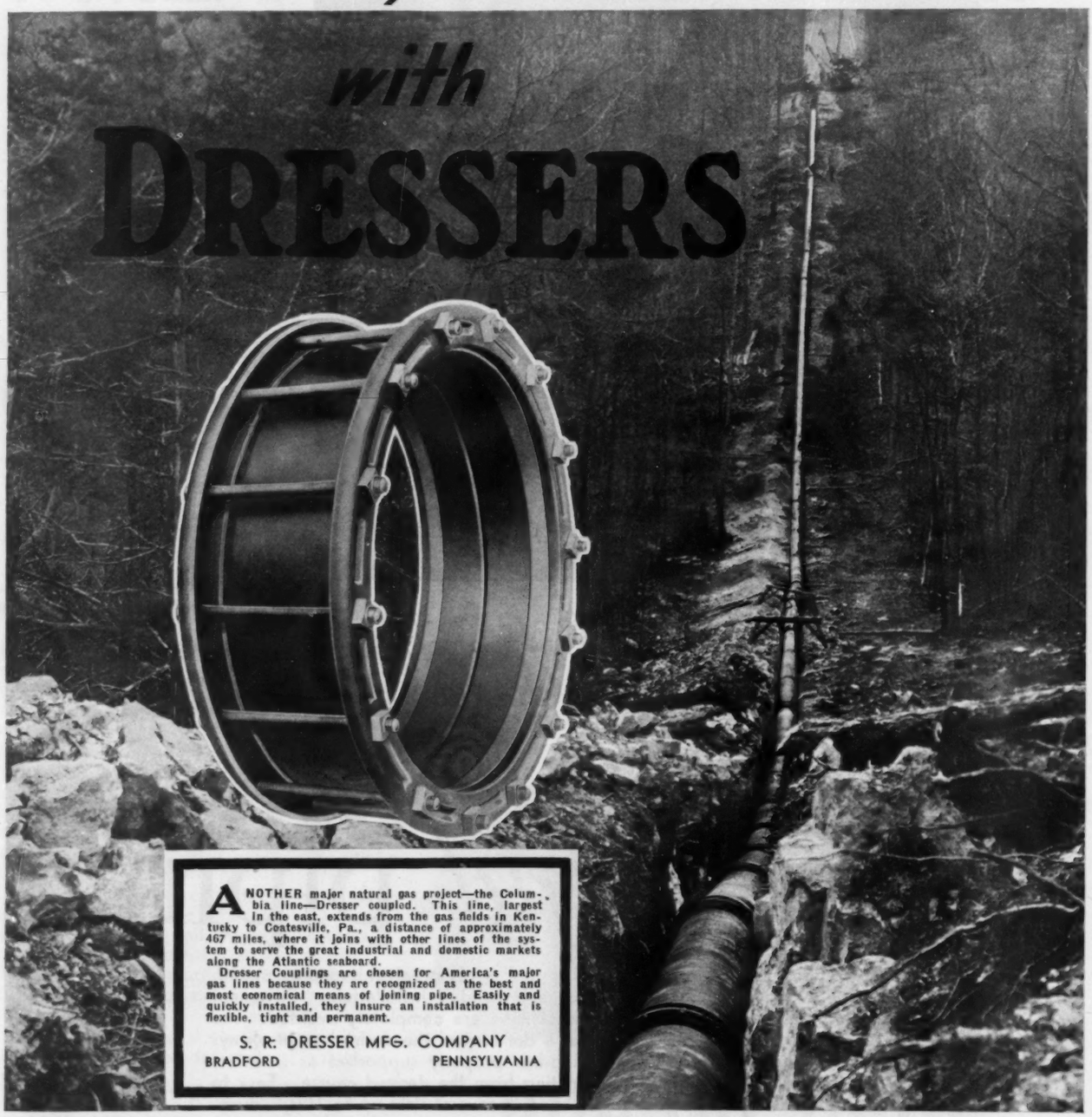
with DRESSERS



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THE PACIFIC COAST GAS ASSOCIATION
AND
THE SOUTHERN CALIFORNIA METER ASSOCIATION

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Contents for November, 1931

Meeting the Attack on the Right to Merchandise 15
By LeRoy M. Edwards

Minnesota Northern's "Perfect Service" Campaign 17
By George H. Finley

Convenient Charts for Flow of Gas Under High Pressure . . . 18
By Frank Wills

Materials and Methods on the Texas-Chicago Carrier 26

Natural Gas Industry Records New Gains in 1930 28
By G. R. Hopkins

Determining Ignition Velocity for Air and Gas Mixtures . . 30
By John Corsiglia

Comparing Gas and Oil for Heating Purposes 32
By Geo. J. Burkhart

PACIFIC COAST GAS ASSOCIATION 33

MEASUREMENT AND CONTROL 38

Recording Instruments in Gas Measurement 38
By W. C. Begeebing

BUTANE-PROPANE NEWS 48

Future Supply . . . from Refinery, or Natural Gasoline Plant? . 48
By B. F. Spigener

Butane-Air Service through Modern Plant at Lakeview, Oregon 50

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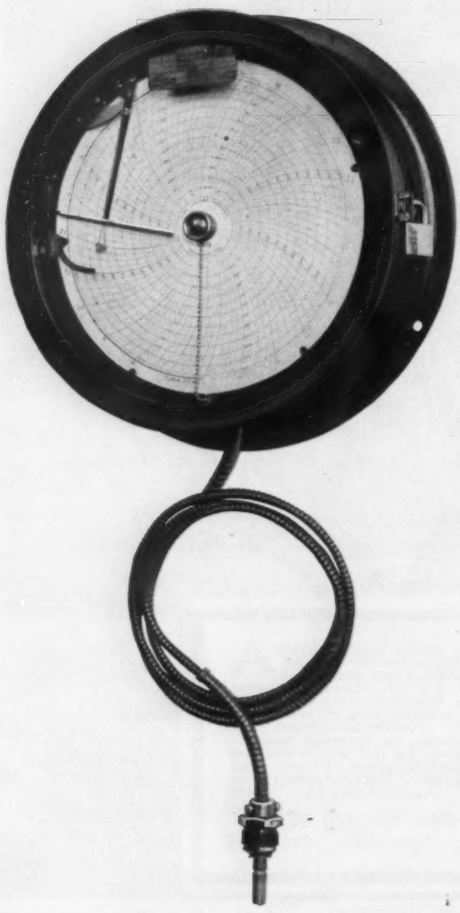
It's a new Recording Thermometer built on an old and proved principle.



Its readings are **not** affected by ambient temperature (i. e., temperature surrounding the case and tubing).

It is fully compensated and is accurate to the nth degree.

Day and night—Summer and Winter, under extreme heat and cold, **true bulb temperatures** are recorded.

The small, sensitive bulb makes it adaptable to any size of gas line.

The "Anti-Ambi" Thermometer is the only one on the market accurate enough for gas line work—and it is rugged. It should always be used wherever extreme accuracy is desired on temperatures below 250° F.

Write today for new Bulletin No. 178.

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REG. U. S. PAT. OFF.
THE COMPASS OF INDUSTRY

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San Francisco Salt Lake City Portland, Ore. Detroit

Instruments for Controlling, Recording and Indicating Temperature, Flow, Humidity and Pressure

November, 1931

WESTERN GAS

Vol. VII, No. 11

"Reg. U. S. Pat. Off."

A Monthly Journal of the Gas and Gas Appliance Industries in *Western America*

Meeting the Attack on *The* Right *to* Merchandise

By LEROY M. EDWARDS
General Counsel
*Southern Counties Gas Company**

DURING the past year a concerted drive was made throughout the United States by certain biased organized associations to secure the enactment of legislation which would absolutely prevent gas and electric utilities from selling or dealing in any and all kinds of appliances. The pinch of the present period of economic depression through which we are passing caused the merchant to inquire into every possible reason for his failure to realize a normal profit in his business. Through a misunderstanding of basic facts, and with a total disregard of the legal rights and responsibilities of the utilities, the movement to ban the utilities from the appliance field rapidly swept across the country, fostered largely by various trade organizations. To increase the utility profits of the local appliance dealer by legislating his utility competitor out of business seemed a simple and very popular solution of the whole economic problem. Bills were introduced before the legislatures of 14 states to drive the utilities out of the appliance field. This legislation succeeded in the States of Kansas and Oklahoma, and failed in California, Alabama, Illinois, Indiana, Iowa, Missouri, Nebraska, Nevada, Pennsylvania, Tennessee, Texas and Wisconsin.

While the measure which was before the California Senate—being Senate Bill 275—was defeated before the Public Utilities Committee of the Senate, we must not for one moment feel that the issue has been closed. It will in all likelihood reappear at the next session of the California Legislature. The Western Furniture Conference held in San Francisco on July second of this year, passed a resolution reading in part as folows:

"Resolved: That the Western Furniture Conference reaffirms its position that the merchandising of appliances is a rightful function of established retail dealers. The Conference seeks the withdrawal of the public utility corporations from the appliance merchandising field in the best mutual interests of our respective groups. The combined cooperative strength of federated associations of the Conference will be enlisted to further the acceptance of this code by the public utility corporations."

While we must be prepared to meet the issue again in the future, I believe we need have no fear of the ultimate result if all of the facts relating to this question are placed before our law-making bodies. The movement to deprive the gas and electric utilities of the right to sell appliances is bound to fail ultimately, because:

1. It is illegal, and violative of our constitutional rights;
2. It is manifestly unfair, in that it would take from the utilities the principal medium through which their business is developed;
3. It is unwise, in that it would cripple the utilities in rendering good service to the public;
4. It is economically unsound, in that it would inevitably result in increasing the cost of utility service;
5. It is unnecessary for the protection of anyone.

Unconstitutional

Corporations possess the powers which are expressly conferred by their charters, together with such powers as are fairly incidental thereto. This is true of public utilities, as well as private corporations. The State cannot, under the guise of regulation, interfere with the proper conduct of the business of the utility corporations in matters which do not fairly belong to the domain of reasonable regulation.

The gas and electric utilities of California have, by their charters, either the express or implied power to sell appliances used and useful in the utilization of gas and electricity. This has already been decided by the courts in other states. In the case of Malone v. Lancaster Gas Light Co., 182 Pa. 309, the right of the gas company to deal in gas appliances was challenged. The Supreme Court of Pennsylvania held that, notwithstanding the fact that the charter of the gas company granted to it the right only "to supply gas," the gas company "might not only supply gas itself, but may also incidentally deal in such appliances and conveniences as will induce new customers to use gas, or old ones to use more."

In December, 1928, a similar case came before the trial court in Pennsylvania, entitled: Commonwealth of Pennsylvania v. The Philadelphia Electric Company. This case involved the right of an electric utility to sell all sorts of electric appliances. The trial court decided that the electric company had the right, as an incidental corporate power, to engage in the business of selling all

*An address before the September annual convention of the Pacific Coast Gas Association at San Francisco, California.

classes of electric appliances. The trial court, among other things, found:

"Electricity is a commodity which can only be used through the medium of some sort of an appliance, and before it can be successfully sold, prospective customers must necessarily be supplied with appliances which, in one form or the other, consume electricity.

"The primary object of respondent in merchandising electrical appliances is to stimulate in every proper way, demand for the use and consumption of electric current, which in turn promotes the respondent's business generally by increasing the sales of such current. An increase in respondent's sales of electric current is a distinct advantage to the consumer because, in its final effect, such increase produces and makes possible a lower energy cost rate to the consumer."

The court stated further:

"Far from preventing the company from dealing in the converting devices needed, it would be our inclination to insist that it is part of its duty to furnish them to its customers. . . . To furnish the housekeeper with the electric current alone would have resulted in neither profit to the company nor convenience to the customer. What the latter wanted, and what the Legislature intended to grant when it authorized the respondent to furnish light, heat and power by electricity, was something more than furnishing the customer with the end of an insulated copper wire, that he did not know how to use, or had not the appliances to use. It was intended that he should have, and the company should furnish, the conveniences that could be obtained by the use of the electric current."

The case was carried to the Supreme Court of Pennsylvania, and the decision of the lower court affirmed, in January of 1930.

In passing I might also add that the Attorney General of Nebraska has recently ruled that a corporation, whether publicly or privately owned, which is chartered only to sell gas, may also sell appliances.

It would seem clear, therefore, that the gas and electric utilities have a lawful right to sell gas and electric appliances under the charter powers granted to them.

The proposed legislation seeking to deprive the utilities of the right to merchandise appliances in my opinion violates the provisions of the Fourteenth Amendment to the Federal Constitution, in that it deprives public utilities of property without due process of law, and of the equal protection of the laws. (See Liggett Co. v. Baldridge, 278 U. S. 105; Mattei v. Hecke, 99 Cal. App. 747.)

The Bill which was introduced before the California Senate was clearly special legislation, and as such in violation of Subdivision 2, Section 25, Article IV of the State Constitution. The classification which denied gas, electric and water utilities the right to sell appliances, yet permitted all other classes of business to deal in appliances, was clearly arbitrary and unreasonable, and not based on any natural, intrinsic or constitutional distinction. There is no substantial reason why the restriction should be imposed upon gas and electric utilities and not generally upon all.

The Proposed Legislation Would Deprive the Utilities of the Principal Medium Through Which Their Business Is Developed.

Neither gas nor electricity can be delivered at the customer's back door like meat, ice or groceries, or the other commodities of common consumption. Gas and electricity can only be sold to a consumer who is equipped with appliances which can be operated by gas or electricity. The market for this type of utility service is one which must be created and developed by salesmanship. The prospective customer must first be sold with the idea that a saving in time, money or convenience can be accomplished through the use of gas or electricity. Neither gas nor electricity can be sold as substances; the interest of the prospective customer can only be aroused by displaying to him an appliance which utilizes gas or electricity. Necessarily, he must be sold a type of appliance which will best meet not only his particular needs, but will stimulate in him the desire to make a further and greater use of gas or electricity in the future. No one who is inclined to be fair can deny the fact that the present high standard of utility service, and the low rates now enjoyed, are due primarily to the large volume of business which has been created by the utilities during the past 20 years. The utilities cannot continue to grow and discharge their duty of furnishing to the people the highest type of service at the lowest reasonable rates unless they are permitted to increase the volume of their business. The volume of business in turn can only be increased through the creation of additional consumer demand.

The very life of the utilities, therefore, depends upon building up the volume of gas and electric appliance sales. The best work of any kind is almost invariably done by the person who has the greatest incentive, and experience has proven that this is true in the case of promoting the sale of gas and electric appliances.

Local tradesmen and merchants are engaged in many lines of merchandizing, and even if they have the initiative to aggressively go after and develop business, seldom do they find it to their profit to diligently exploit the sale of a particular type of merchandise, and consequently are not interested in doing so.

The average merchant generally finds it necessary to handle publicly accepted and established lines and he is naturally opposed to risking his time and capital in promoting new appliances or working with manufacturers to produce better articles. It is illogical, therefore, to presume that the task of aggressively selling gas and electric appliances (the only means by which the commodities gas and electricity can be sold) can be left exclusively to the dealers.

The appliances which today are employed for the utilization of gas or electricity have, in nearly every instance, not only been developed by the gas and electrical industry, but the pioneering work of educating and inducing the public to accept and use these appliances has been carried on almost exclusively by the utilities themselves—a work which has entailed a tremendous expenditure of time, energy and capital.

Today the gas stove is a staple commodity. Not many years ago the gas companies practically gave gas stoves away in order to induce people to even try them. The electric iron and many of the types of electric appliances that are now considered indispensable household articles, won their present popularity only after the electric utilities had spent fortunes in proving to the public that they were useful and economical. The appliance that is modern today may soon become old-fashioned or obsolete. New improvements are constantly being brought forward. New appliances are invented yearly. The convenience of the public and the development of the utilities require that these new and improved appliances be utilized by the public.

Normally, no one but the utilities will ever take the time or spend the money necessary to place these new or improved appliances with the consuming public. The gas and electric utilities in California spend hundreds of thousands of dollars annually in advertising in the newspapers, magazines and billboards, new and improved types of gas and electric appliances. These companies are spending this year in excess of one million dollars for this type of promotional work.

You are familiar, of course, with the type of advertising which the utilities of California are now putting before the public. In almost every instance these advertisements urge the consuming public to obtain their appliances through their local dealers. There is no attempt made upon the part of the utilities to secure exclusively for themselves the sales of these appliances. Such an advertising policy is manifestly most fair, and is of great value to the local dealer.

Reliable statistics show that throughout the country as a whole, only 30 per cent of the appliances sold are sold by the utilities. In the larger cities this percentage drops as low as 15 per cent, while in the smaller communities, where

(Continued on Page 41)

Minnesota Northern's

"Perfect Service" Campaign

By GEORGE H. FINLEY
Managing Editor, Western Gas

MOST campaigns conducted by utility companies have for their motive the accomplishment of some one limited purpose. While the campaign may involve participation of several departments, it usually centers about a single objective—building gas load through sale of househeating equipment, increasing customer owners by securities sales, etc.

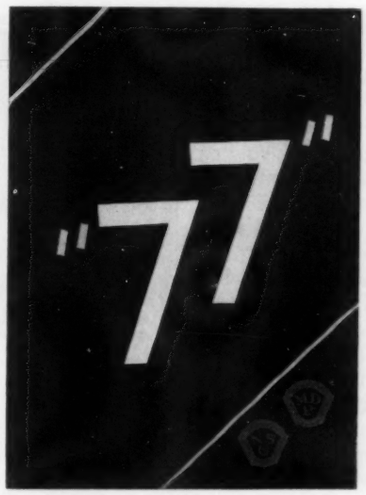
Something quite different is under way for the Minnesota Northern Power Co., headquartered at Minneapolis and operating a number of progressive utilities in Montana, Wyoming, and the Dakotas. From October 1 to December 16—a 77-day period—this company is keying up its personnel to render perfect service in every department, sales, accounting, operating, engineering.

Conceived by the company's business promotional department, the campaign has behind it the support of every company executive, and three company directors are serving as a committee to judge the performance and award divisional prizes on the basis of the over-all showing made in each section. The aim of the campaign is perfectly integrated cooperation of all employees in all departments, to the end of perfect service.

Some of the particular objectives held before the company's 13 divisions are the reduction of old merchandise stocks, the collection of delinquent accounts, addition of new customers, increase in load, and maintenance of uninterrupted service in all phases of work.

An ambitious program of this sort called for a special name and a special kind of treatment, to get the wholehearted cooperation of every employee. And the campaign committee, headed by A. E. Schwarz, commercial manager for Minnesota Northern, worked out a campaign motif which lends itself admirably to the purpose. It was decided to let the magic figure "7" dominate the entire proceedings. A 77-day campaign period was consequently selected and the period officially designated as the "77 campaign"; all sales quotas featured the figure 7, and in a variety of ways, this campaign talisman was given prominence.

Interest in the "77" campaign was generated by the "teaser" method; that is, the whole story was not told at once,



The "77 campaign" motif features the magic number—7—which dominates all publicity. Above is shown the cover of the campaign prospectus booklet.

but was built around the mystic "77" until interest was at a high pitch. To introduce this interest-building program, all correspondence leaving company headquarters was stamped with a special "77" imprint, no further explanation being supplied. At the same time advertisements, consisting merely of the figure "77," were carried in newspapers throughout the company's territory. Cards, radio announcements, more ads, helped build customer interest, and the complete campaign announcement was withheld until October 1.

Employees were given buttons to wear—white figure "77" on a black background. Officials were mailed paper weights with cutout "77" figures on wood, painted gold on a black base. Bulletins were mailed out two and three times weekly from the Minneapolis office, gradually supplying details of the "77" Campaign. These bulletins are being continued during the campaign.

Other interest creators include special window displays, special dice — so mounted that only 7's may be read—and other special advertising featuring campaign merchandise offers. A very complete prospectus was prepared and distributed to the campaign judges, and to various district managers.

Company divisions were given considerable latitude in developing their own "77" organizations and use of original methods for stirring up the enthusiasm of local employees.

In the October issue of "The Link," Minnesota Northern's company publication, employees were also acquainted with campaign details.

Prize inducements were set up for the 13 division managers to strive for. First prize is a set of office furniture, valued at $777.77. Second prize is $77.77 in cash. And third, is cash to the amount of $7.77. As a part of the securities and merchandise sales plans, special commissions are arranged for salesmen and for employees submitting names of prospects who are sold by salesmen.

During campaign dates the company will work to secure:

77 central heating plants.

177 gas range sales

777 new heating customers.

Sale of 777 shares of stock.

77 days of safety (no accident).

Quotas applying to electric departments were in similar form—777 outdoor Christmas trees, etc.

Suggestions for novel ways for local divisions to tie into the "77" idea were made by the campaign management, and included these:

A—Place cards in your windows with a large "77" on it—nothing more, for a week prior to October first and get people asking questions about "77."

B—Take some item in stock and reduce the price 77c each day for 77 days. Place a card on it, telling the story. People who are interested in it will look at it or buy it before someone else does. Put up a second item, if you care to. Make your card big. Either draw a red line through the old figure and put up new price, or list the price each day on the card, and cross off the previous day's price each morning.

(Continued on Page 54)

Convenient Charts *for* Flow *of* Gas *under* High Pressure

By FRANK WILLS
Engineer of Production
Pacific Gas and Electric Company

USUALLY the calculation of the capacity of pipe lines or the determination of the diameter or pressures required for the delivery of a given volume of gas does not require extreme accuracy. In fact, the usual flow formulæ do not necessarily apply exactly to the actual conditions existing within the pipe lines, so attempts at very accurate computations are useless. For this reason the use of graphs or similar devices for practical work is justified. The time saved is considerable and the mathematical effort is reduced to such an extent that many problems may be solved successfully by employees who would otherwise find them too difficult.

Many such charts have been available in a great variety of forms. The six charts presented here are perhaps no better than many others, but in their preparation considerable thought has been given to simplicity, as well as accuracy. A minimum number of lines are drawn across the page in order to avoid confusion. After some experience it may be found of advantage to draw in more of the straight lines connecting the length scale with the zero in the lower right hand corner. This will improve the utility of the charts, but the number and choice of lines depend upon the particular need of the individual. They were purposely omitted, knowing that the greatest difficulty in introducing such graphs is to obtain the conviction that they are truly simple and really useful.

These charts cover the major portion of the flow problems in high pressure distribution and transmission. They are based on Weymouth's Formula, using a specific gravity of 0.654, correcting the quantity delivered to standard conditions of 60° F. and 14.73 pounds per square inch, and considering the temperature of the flowing gas in the line at 60° F. Of these conditions, the specific gravity is the only one for which there need be any concern for ordinary use and with any gas. Table No. 1 contains specific gravity correction factors, but need not be used unless the gravity differs widely from 0.654. When calculating the capacity of a pipe line, the final volume obtained from the chart is multiplied by the specific gravity correction factor. When the volume of gas is known, from which it is desired to calculate either the inlet or outlet pressures, or the pipe diameter, the known volume should be divided by the specific gravity correction factor to obtain the equivalent volume of 0.654 specific gravity gas for use on the charts. If the charts are to be used regularly for a gas having a specific gravity differing considerably from 0.654, the entire capacity scale on each chart may be corrected by multiplying with the corresponding correction factor; thus eliminating the necessity of considering the specific gravity in each computation.

Frank Wills

Figs. 1, 2, 3 and 4 are charts that are complete in themselves. Each has a limited range in diameter, length and pressures. However, the range of each overlaps that of the succeeding chart, so that this group covers the ordinary range of distribution and transmission work. If, in some unusual case, it is not possible to obtain a location on the length scale that is convenient for obtaining an accurate capacity reading, use a length either 10 times or 1/10 of the actual length and multiply (if 10 is used) or divide (if 1/10 is used) the capacity so found by 3-1/6 (the square root of 10) to obtain the correct capacity.

It can be noted in all these charts that, for accurate readings, there is an optimum position for the diameter line with reference to the pressure scales and length lines. For fairly accurate work it is therefore necessary to have a number of charts with a few diameter lines upon each, or one chart with one diameter line and convert the length of all pipe lines to equivalent lengths of that diameter. This is the purpose of Fig. 5 which, if properly used, yields quite accurate results. The scales are so arranged that the diameter line is straight. Only one is drawn and it is well located, being at about 45 degrees on the page. From Fig. 6 or Table No. 3 the length of a 20-inch (19.4375 I.D.) pipe having a capacity equal to that for the length and size of the given line is readily obtained. This equivalent length of 19.4375 I.D. diameter is used for all the calculations in Fig. 5.

Two additional scales have been drawn in Fig. 5: Scales E and D. In case the equivalent length does not fall within the range of the most convenient part of the scale (B), use the portion of the length scale (B) corresponding to 10 times the actual equivalent length and read the capacity directly on scale D instead of C. If more convenient, use a portion of the scale (B) corresponding to 1/10 the actual equivalent length and read the capacity directly on scale E.

Tables No. 2 and No. 3 have been added for general information. Only a portion of Table No. 3 is directly applicable to use with Fig. 5.

The tedious task of calculating the data and preparing the graphs was the work of O. A. Philpott and R. H. Talmadge under the direction of Harry J. Smith, engineer of construction for the Pacific Gas and Electric Co. Only the general method and procedure for designing the charts may be credited to the writer.

TABLE No. 1

Specific Gravity	Correction Factor	Specific Gravity	Correction Factor
.74	0.94	.54	1.10
.72	0.95	.52	1.12
.70	0.97	.50	1.14
.68	0.98	.48	1.17
.654	1.00	.46	1.19
.64	1.01	.44	1.22
.62	1.03	.42	1.25
.60	1.04	.40	1.28
.58	1.06	.38	1.31
56	1.08	.36	1.35

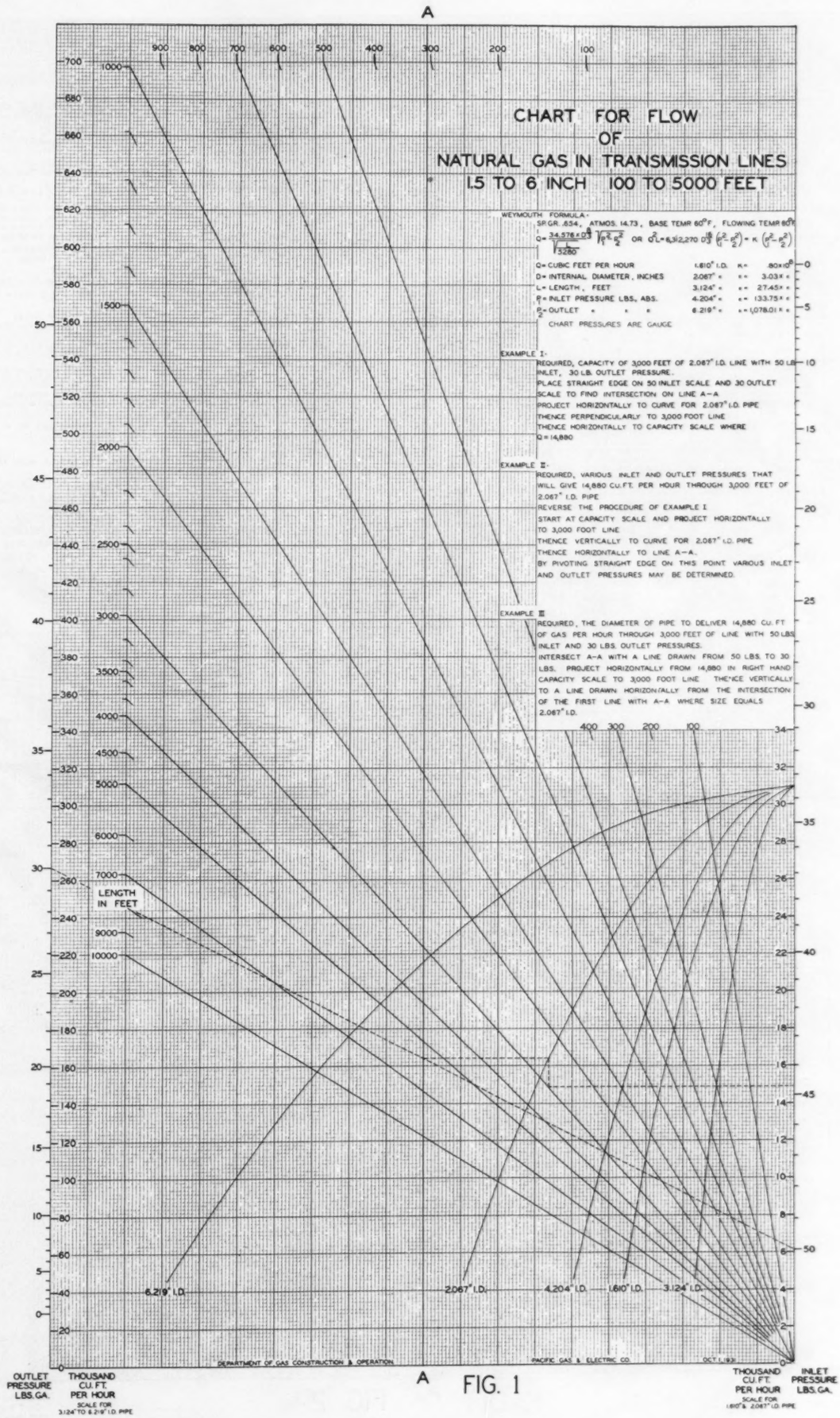

A
CHART FOR FLOW
OF
NATURAL GAS IN TRANSMISSION LINES
1.5 TO 6 INCH 100 TO 5000 FEET
WEYMOUTH FORMULA:-
SP.GR. .634, ATMOS. 14.73, BASE TEMP 60°F, FLOWING TEMP 60°F
Q= CUBIC FEET PER HOUR
D= INTERNAL DIAMETER, INCHES
L= LENGTH, FEET
P1= INLET PRESSURE LBS., ABS.
P2= OUTLET " " "
1.610" I.D. K= .80x10^8
2.067" " K= 3.03 K
3.124" " K= 27.45 K
4.204" " K= 133.75 K
6.219" " K= 1,078.01 K
CHART PRESSURES ARE GAUGE
EXAMPLE I:-
REQUIRED, CAPACITY OF 3,000 FEET OF 2.067" I.D. LINE WITH 50 LB. INLET, 30 LB. OUTLET PRESSURE.
PLACE STRAIGHT EDGE ON 50 INLET SCALE AND 30 OUTLET SCALE TO FIND INTERSECTION ON LINE A—A
PROJECT HORIZONTALLY TO CURVE FOR 2.067" I.D. PIPE
THENCE PERPENDICULARLY TO 3,000 FOOT LINE
THENCE HORIZONTALLY TO CAPACITY SCALE WHERE Q = 14,880
EXAMPLE II:-
REQUIRED, VARIOUS INLET AND OUTLET PRESSURES THAT WILL GIVE 14,880 CU. FT. PER HOUR THROUGH 3,000 FEET OF 2.067" I.D. PIPE
REVERSE THE PROCEDURE OF EXAMPLE I.
START AT CAPACITY SCALE AND PROJECT HORIZONTALLY TO 3,000 FOOT LINE
THENCE VERTICALLY TO CURVE FOR 2.067" I.D. PIPE
THENCE HORIZONTALLY TO LINE A—A.
BY PIVOTING STRAIGHT EDGE ON THIS POINT VARIOUS INLET AND OUTLET PRESSURES MAY BE DETERMINED.
EXAMPLE III:
REQUIRED, THE DIAMETER OF PIPE TO DELIVER 14,880 CU. FT. OF GAS PER HOUR THROUGH 3,000 FEET OF LINE WITH 50 LBS. INLET AND 30 LBS. OUTLET PRESSURES.
INTERSECT A—A WITH A LINE DRAWN FROM 50 LBS. TO 30 LBS. PROJECT HORIZONTALLY FROM 14,880 IN RIGHT HAND CAPACITY SCALE TO 3,000 FOOT LINE. THENCE VERTICALLY TO A LINE DRAWN HORIZONTALLY FROM THE INTERSECTION OF THE FIRST LINE WITH A—A WHERE SIZE EQUALS 2.067" I.D.
LENGTH IN FEET
6.219" I.D.
2.067" I.D.
4.204" I.D.
1.610" I.D.
3.124" I.D.
DEPARTMENT OF GAS CONSTRUCTION & OPERATION
PACIFIC GAS & ELECTRIC CO.
OCT. 1, 1931
OUTLET PRESSURE LBS. GA.
THOUSAND CU. FT. PER HOUR
SCALE FOR 3.124" TO 6.219" I.D. PIPE
THOUSAND CU. FT. PER HOUR
SCALE FOR 1.610" & 2.067" I.D. PIPE
INLET PRESSURE LBS. GA.
A

FIG. 1

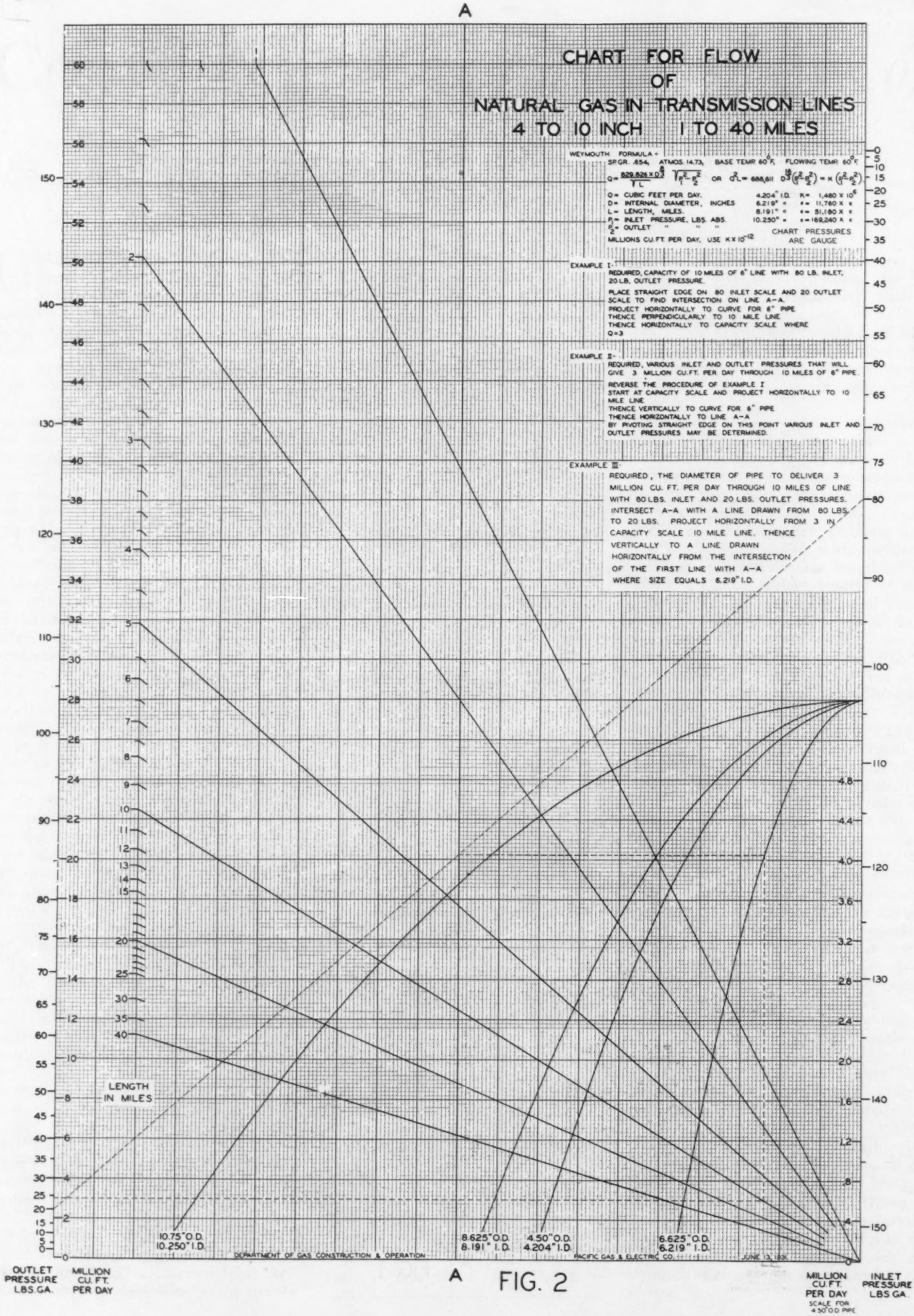

A
CHART FOR FLOW
OF
NATURAL GAS IN TRANSMISSION LINES
4 TO 10 INCH 1 TO 40 MILES
WEYMOUTH FORMULA =
SP.GR. .654, ATMOS. 14.73, BASE TEMP 60° F, FLOWING TEMP. 60° F
Q = CUBIC FEET PER DAY.
D = INTERNAL DIAMETER, INCHES
L = LENGTH, MILES.
P1 = INLET PRESSURE, LBS. ABS.
P2 = OUTLET " "
MILLIONS CU.FT PER DAY, USE K x 10⁻¹²
4.204" I.D. K = 1,480 X 10⁶
6.219" " = 11,780 X "
8.191" " = 51,180 X "
10.250" " = 189,240 X "
CHART PRESSURES ARE GAUGE
EXAMPLE I-
REQUIRED, CAPACITY OF 10 MILES OF 6" LINE WITH 80 LB. INLET, 20 LB. OUTLET PRESSURE.
PLACE STRAIGHT EDGE ON 80 INLET SCALE AND 20 OUTLET SCALE TO FIND INTERSECTION ON LINE A-A.
PROJECT HORIZONTALLY TO CURVE FOR 6" PIPE
THENCE PERPENDICULARLY TO 10 MILE LINE
THENCE HORIZONTALLY TO CAPACITY SCALE WHERE Q=3
EXAMPLE II-
REQUIRED, VARIOUS INLET AND OUTLET PRESSURES THAT WILL GIVE 3 MILLION CU.FT. PER DAY THROUGH 10 MILES OF 6" PIPE.
REVERSE THE PROCEDURE OF EXAMPLE I
START AT CAPACITY SCALE AND PROJECT HORIZONTALLY TO 10 MILE LINE
THENCE VERTICALLY TO CURVE FOR 6" PIPE
THENCE HORIZONTALLY TO LINE A-A
BY PIVOTING STRAIGHT EDGE ON THIS POINT VARIOUS INLET AND OUTLET PRESSURES MAY BE DETERMINED.
EXAMPLE III-
REQUIRED, THE DIAMETER OF PIPE TO DELIVER 3 MILLION CU. FT. PER DAY THROUGH 10 MILES OF LINE WITH 80 LBS. INLET AND 20 LBS. OUTLET PRESSURES. INTERSECT A-A WITH A LINE DRAWN FROM 80 LBS. TO 20 LBS. PROJECT HORIZONTALLY FROM 3 IN CAPACITY SCALE 10 MILE LINE. THENCE VERTICALLY TO A LINE DRAWN HORIZONTALLY FROM THE INTERSECTION OF THE FIRST LINE WITH A-A WHERE SIZE EQUALS 6.219" I.D.
LENGTH IN MILES
10.75" O.D. 10.250" I.D.
8.625" O.D. 8.191" I.D.
4.50" O.D. 4.204" I.D.
6.625" O.D. 6.219" I.D.
DEPARTMENT OF GAS CONSTRUCTION & OPERATION
PACIFIC GAS & ELECTRIC CO.
JUNE 13, 1930
OUTLET PRESSURE LBS. GA.
MILLION CU. FT. PER DAY
MILLION CU FT. PER DAY SCALE FOR 4.50" O.D. PIPE
INLET PRESSURE LBS GA.
A

FIG. 2

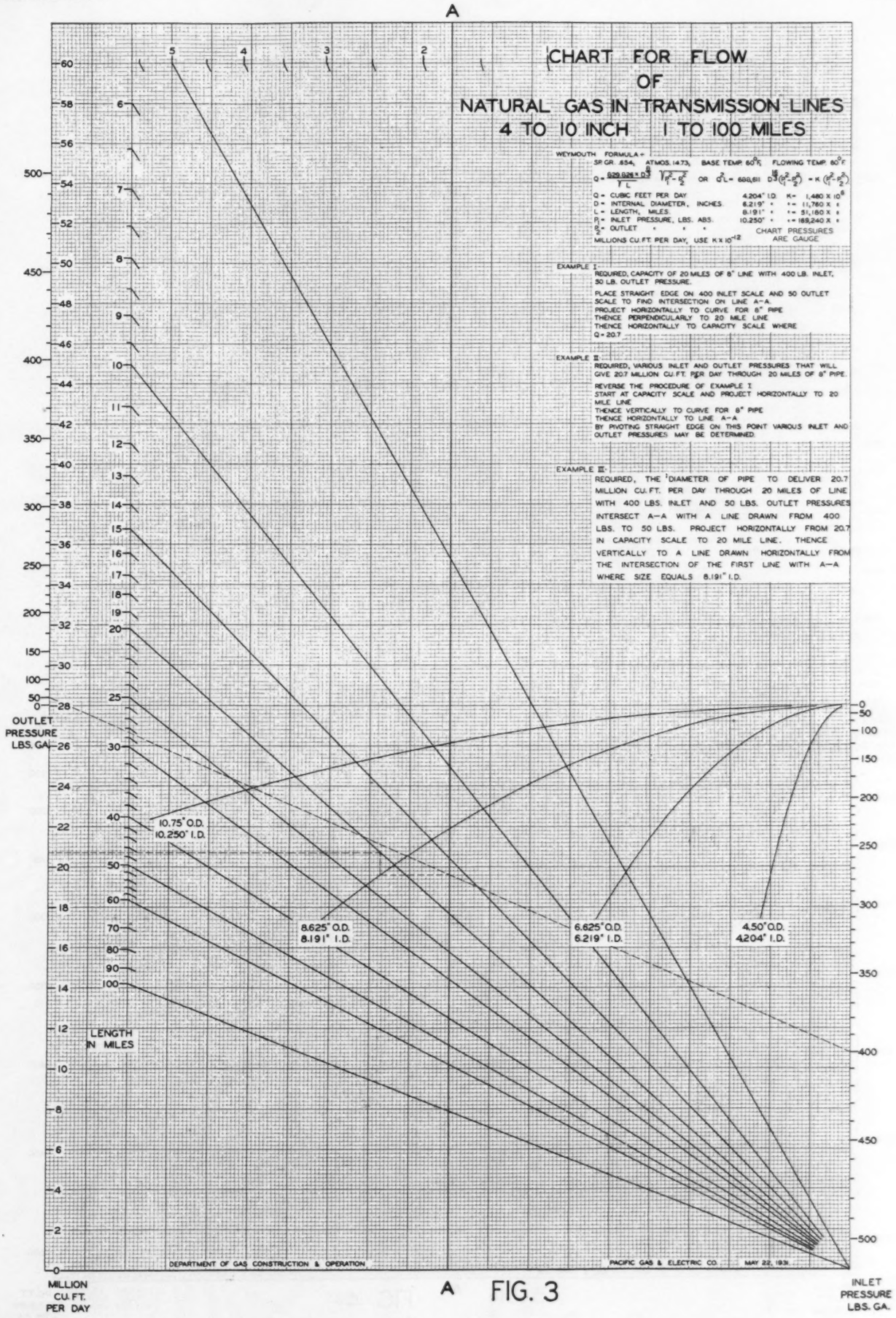

A
CHART FOR FLOW
OF
NATURAL GAS IN TRANSMISSION LINES
4 TO 10 INCH 1 TO 100 MILES
WEYMOUTH FORMULA =
SP GR .654, ATMOS. 14.73, BASE TEMP. 60°F, FLOWING TEMP. 60°F
Q = CUBIC FEET PER DAY
D = INTERNAL DIAMETER, INCHES
L = LENGTH, MILES
P1 = INLET PRESSURE, LBS. ABS.
P2 = OUTLET " " "
MILLIONS CU.FT. PER DAY, USE K x 10^-12
4.204" I.D. K = 1,480 X 10^6
6.219" " = 11,760 X "
8.191" " = 51,180 X "
10.250" " = 189,240 X "
CHART PRESSURES ARE GAUGE
EXAMPLE I:
REQUIRED, CAPACITY OF 20 MILES OF 8" LINE WITH 400 LB. INLET, 50 LB. OUTLET PRESSURE.
PLACE STRAIGHT EDGE ON 400 INLET SCALE AND 50 OUTLET SCALE TO FIND INTERSECTION ON LINE A-A.
PROJECT HORIZONTALLY TO CURVE FOR 8" PIPE
THENCE PERPENDICULARLY TO 20 MILE LINE
THENCE HORIZONTALLY TO CAPACITY SCALE WHERE Q = 20.7
EXAMPLE II:
REQUIRED, VARIOUS INLET AND OUTLET PRESSURES THAT WILL GIVE 20.7 MILLION CU.FT. PER DAY THROUGH 20 MILES OF 8" PIPE.
REVERSE THE PROCEDURE OF EXAMPLE I.
START AT CAPACITY SCALE AND PROJECT HORIZONTALLY TO 20 MILE LINE
THENCE VERTICALLY TO CURVE FOR 8" PIPE
THENCE HORIZONTALLY TO LINE A-A
BY PIVOTING STRAIGHT EDGE ON THIS POINT VARIOUS INLET AND OUTLET PRESSURES MAY BE DETERMINED.
EXAMPLE III:
REQUIRED, THE DIAMETER OF PIPE TO DELIVER 20.7 MILLION CU.FT. PER DAY THROUGH 20 MILES OF LINE WITH 400 LBS. INLET AND 50 LBS. OUTLET PRESSURES
INTERSECT A-A WITH A LINE DRAWN FROM 400 LBS. TO 50 LBS. PROJECT HORIZONTALLY FROM 20.7 IN CAPACITY SCALE TO 20 MILE LINE. THENCE VERTICALLY TO A LINE DRAWN HORIZONTALLY FROM THE INTERSECTION OF THE FIRST LINE WITH A-A WHERE SIZE EQUALS 8.191" I.D.
OUTLET PRESSURE LBS. GA.
10.75" O.D.
10.250" I.D.
8.625" O.D.
8.191" I.D.
6.625" O.D.
6.219" I.D.
4.50" O.D.
4.204" I.D.
LENGTH IN MILES
DEPARTMENT OF GAS CONSTRUCTION & OPERATION
PACIFIC GAS & ELECTRIC CO. MAY 22, 1931
MILLION CU. FT. PER DAY
INLET PRESSURE LBS. GA.
A

FIG. 3

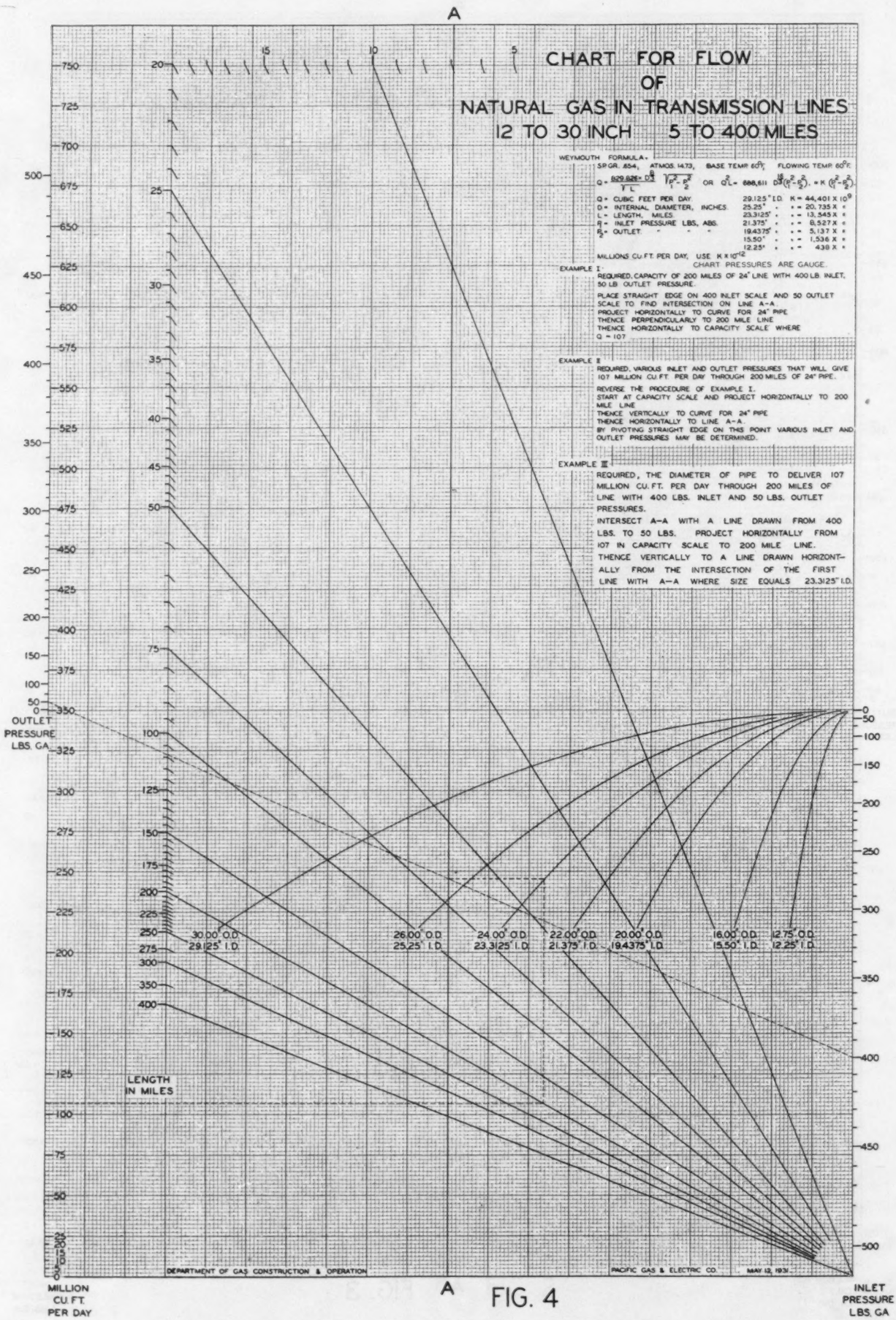

A
CHART FOR FLOW
OF
NATURAL GAS IN TRANSMISSION LINES
12 TO 30 INCH 5 TO 400 MILES
WEYMOUTH FORMULA - SP GR. .654, ATMOS. 1473, BASE TEMP 60°F, FLOWING TEMP 60°F.
Q = CUBIC FEET PER DAY.
D = INTERNAL DIAMETER, INCHES.
L = LENGTH, MILES.
P1 = INLET PRESSURE LBS. ABS.
P2 = OUTLET " " "
MILLIONS CU.FT. PER DAY, USE K X 10-12
29.125" I.D. K = 44,401 X 10^9
25.25" " = 20,735 X "
23.3125" " = 13,545 X "
21.375" " = 8,527 X "
19.4375" " = 5,137 X "
15.50" " = 1,536 X "
12.25" " = 438 X "
CHART PRESSURES ARE GAUGE.
EXAMPLE I:
REQUIRED, CAPACITY OF 200 MILES OF 24" LINE WITH 400 LB. INLET, 50 LB OUTLET PRESSURE.
PLACE STRAIGHT EDGE ON 400 INLET SCALE AND 50 OUTLET SCALE TO FIND INTERSECTION ON LINE A-A.
PROJECT HORIZONTALLY TO CURVE FOR 24" PIPE
THENCE PERPENDICULARLY TO 200 MILE LINE
THENCE HORIZONTALLY TO CAPACITY SCALE WHERE Q = 107
EXAMPLE II
REQUIRED, VARIOUS INLET AND OUTLET PRESSURES THAT WILL GIVE 107 MILLION CU.FT. PER DAY THROUGH 200 MILES OF 24" PIPE.
REVERSE THE PROCEDURE OF EXAMPLE I.
START AT CAPACITY SCALE AND PROJECT HORIZONTALLY TO 200 MILE LINE
THENCE VERTICALLY TO CURVE FOR 24" PIPE
THENCE HORIZONTALLY TO LINE A-A.
BY PIVOTING STRAIGHT EDGE ON THIS POINT VARIOUS INLET AND OUTLET PRESSURES MAY BE DETERMINED.
EXAMPLE III
REQUIRED, THE DIAMETER OF PIPE TO DELIVER 107 MILLION CU. FT. PER DAY THROUGH 200 MILES OF LINE WITH 400 LBS. INLET AND 50 LBS. OUTLET PRESSURES.
INTERSECT A-A WITH A LINE DRAWN FROM 400 LBS. TO 50 LBS. PROJECT HORIZONTALLY FROM 107 IN CAPACITY SCALE TO 200 MILE LINE.
THENCE VERTICALLY TO A LINE DRAWN HORIZONTALLY FROM THE INTERSECTION OF THE FIRST LINE WITH A-A WHERE SIZE EQUALS 23.3125" I.D.
OUTLET PRESSURE LBS. GA
LENGTH IN MILES
30.00" O.D. 29.125" I.D.
26.00" O.D. 25.25" I.D.
24.00" O.D. 23.3125" I.D.
22.00" O.D. 21.375" I.D.
20.00" O.D. 19.4375" I.D.
16.00" O.D. 15.50" I.D.
12.75" O.D. 12.25" I.D.
DEPARTMENT OF GAS CONSTRUCTION & OPERATION
PACIFIC GAS & ELECTRIC CO. MAY 12, 1931
MILLION CU. FT. PER DAY
A
INLET PRESSURE LBS. GA

FIG. 4

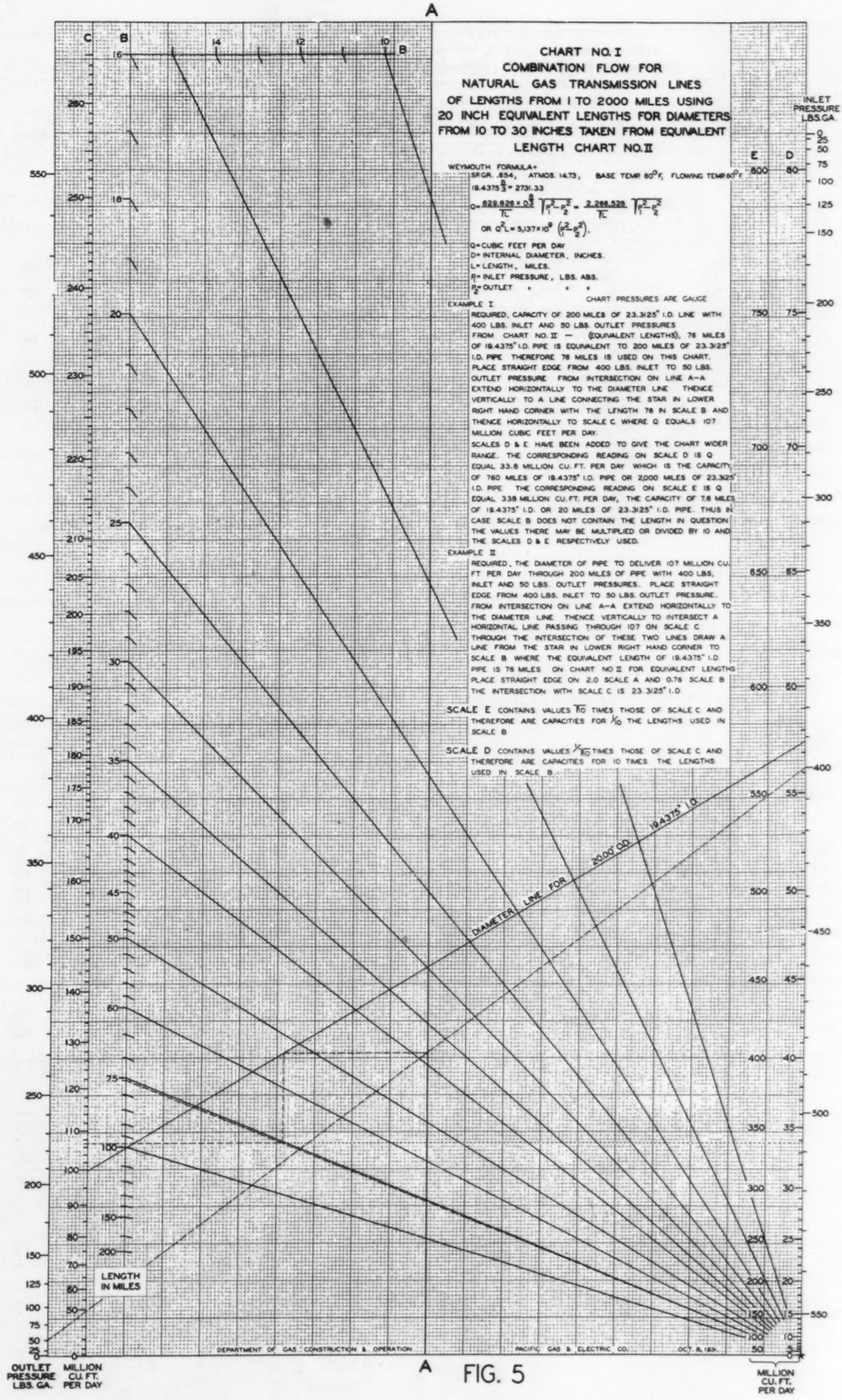

A
CHART NO. I
COMBINATION FLOW FOR
NATURAL GAS TRANSMISSION LINES
OF LENGTHS FROM 1 TO 2000 MILES USING
20 INCH EQUIVALENT LENGTHS FOR DIAMETERS
FROM 10 TO 30 INCHES TAKEN FROM EQUIVALENT
LENGTH CHART NO. II
WEYMOUTH FORMULA+
SP.GR. .654, ATMOS. 14.73, BASE TEMP. 60°F, FLOWING TEMP 60°F.
$19.4375^{\frac{8}{3}} = 2731.33$
$Q = \frac{829,626 \times D^{\frac{8}{3}}}{\sqrt{L}} \sqrt{P_1^2 - P_2^2} = \frac{2,266,529}{\sqrt{L}} \sqrt{P_1^2 - P_2^2}$
OR $Q^2 L = 5,137 \times 10^9 \left(P_1^2 - P_2^2\right)$.
Q = CUBIC FEET PER DAY
D = INTERNAL DIAMETER, INCHES.
L = LENGTH, MILES.
P_1 = INLET PRESSURE, LBS. ABS.
P_2 = OUTLET " " "
CHART PRESSURES ARE GAUGE
EXAMPLE I
REQUIRED, CAPACITY OF 200 MILES OF 23.3125" I.D. LINE WITH 400 LBS. INLET AND 50 LBS. OUTLET PRESSURES
FROM CHART NO. II — (EQUIVALENT LENGTHS), 78 MILES OF 19.4375" I.D. PIPE IS EQUIVALENT TO 200 MILES OF 23.3125" I.D. PIPE. THEREFORE 78 MILES IS USED ON THIS CHART.
PLACE STRAIGHT EDGE FROM 400 LBS. INLET TO 50 LBS. OUTLET PRESSURE. FROM INTERSECTION ON LINE A—A EXTEND HORIZONTALLY TO THE DIAMETER LINE. THENCE VERTICALLY TO A LINE CONNECTING THE STAR IN LOWER RIGHT HAND CORNER WITH THE LENGTH 78 IN SCALE B AND THENCE HORIZONTALLY TO SCALE C WHERE Q EQUALS 107 MILLION CUBIC FEET PER DAY.
SCALES D & E HAVE BEEN ADDED TO GIVE THE CHART WIDER RANGE. THE CORRESPONDING READING ON SCALE D IS Q EQUAL 33.8 MILLION CU. FT. PER DAY WHICH IS THE CAPACITY OF 760 MILES OF 19.4375" I.D. PIPE OR 2,000 MILES OF 23.3125" I.D. PIPE. THE CORRESPONDING READING ON SCALE E IS Q EQUAL 338 MILLION CU. FT. PER DAY, THE CAPACITY OF 7.6 MILES OF 19.4375" I.D. OR 20 MILES OF 23.3125" I.D. PIPE. THUS IN CASE SCALE B DOES NOT CONTAIN THE LENGTH IN QUESTION THE VALUES THERE MAY BE MULTIPLIED OR DIVIDED BY 10 AND THE SCALES D & E RESPECTIVELY USED.
EXAMPLE II
REQUIRED, THE DIAMETER OF PIPE TO DELIVER 107 MILLION CU. FT PER DAY THROUGH 200 MILES OF PIPE WITH 400 LBS. INLET AND 50 LBS. OUTLET PRESSURES. PLACE STRAIGHT EDGE FROM 400 LBS. INLET TO 50 LBS. OUTLET PRESSURE. FROM INTERSECTION ON LINE A—A EXTEND HORIZONTALLY TO THE DIAMETER LINE. THENCE VERTICALLY TO INTERSECT A HORIZONTAL LINE PASSING THROUGH 107 ON SCALE C. THROUGH THE INTERSECTION OF THESE TWO LINES DRAW A LINE FROM THE STAR IN LOWER RIGHT HAND CORNER TO SCALE B WHERE THE EQUIVALENT LENGTH OF 19.4375" I.D. PIPE IS 78 MILES. ON CHART NO. II FOR EQUIVALENT LENGTHS PLACE STRAIGHT EDGE ON 2.0 SCALE A AND 0.76 SCALE B THE INTERSECTION WITH SCALE C IS 23.3125" I.D.
SCALE E CONTAINS VALUES $\sqrt{10}$ TIMES THOSE OF SCALE C AND THEREFORE ARE CAPACITIES FOR $1/10$ THE LENGTHS USED IN SCALE B.
SCALE D CONTAINS VALUES $1/\sqrt{10}$ TIMES THOSE OF SCALE C AND THEREFORE ARE CAPACITIES FOR 10 TIMES THE LENGTHS USED IN SCALE B.
DIAMETER LINE FOR 20.00" OD 19.4375" I.D.
LENGTH IN MILES
INLET PRESSURE LBS.GA.
OUTLET PRESSURE LBS. GA.
MILLION CU. FT. PER DAY
MILLION CU. FT. PER DAY
DEPARTMENT OF GAS CONSTRUCTION & OPERATION
PACIFIC GAS & ELECTRIC CO.
OCT. 8, 1931.
A

FIG. 5

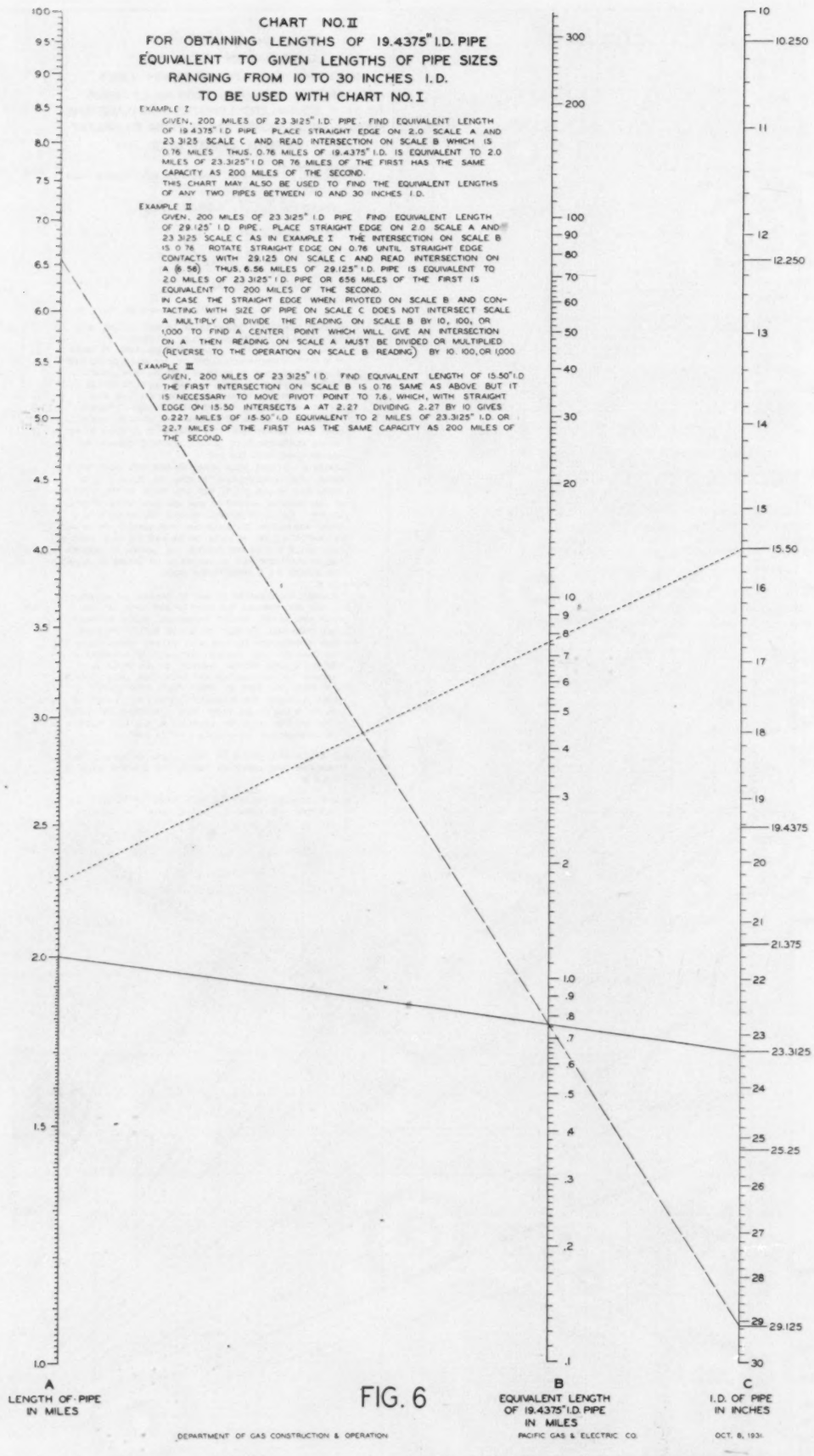


CHART NO. II
FOR OBTAINING LENGTHS OF 19.4375" I.D. PIPE
EQUIVALENT TO GIVEN LENGTHS OF PIPE SIZES
RANGING FROM 10 TO 30 INCHES I. D.
TO BE USED WITH CHART NO. I
EXAMPLE I
GIVEN, 200 MILES OF 23.3125" I.D. PIPE. FIND EQUIVALENT LENGTH OF 19.4375" I.D. PIPE. PLACE STRAIGHT EDGE ON 2.0 SCALE A AND 23.3125 SCALE C AND READ INTERSECTION ON SCALE B WHICH IS 0.76 MILES. THUS, 0.76 MILES OF 19.4375" I.D. IS EQUIVALENT TO 2.0 MILES OF 23.3125" I.D. OR 76 MILES OF THE FIRST HAS THE SAME CAPACITY AS 200 MILES OF THE SECOND.
THIS CHART MAY ALSO BE USED TO FIND THE EQUIVALENT LENGTHS OF ANY TWO PIPES BETWEEN 10 AND 30 INCHES I.D.
EXAMPLE II
GIVEN, 200 MILES OF 23.3125" I.D. PIPE. FIND EQUIVALENT LENGTH OF 29.125" I.D. PIPE. PLACE STRAIGHT EDGE ON 2.0 SCALE A AND 23.3125 SCALE C AS IN EXAMPLE I. THE INTERSECTION ON SCALE B IS 0.76. ROTATE STRAIGHT EDGE ON 0.76 UNTIL STRAIGHT EDGE CONTACTS WITH 29.125 ON SCALE C AND READ INTERSECTION ON A (6.56). THUS, 6.56 MILES OF 29.125" I.D. PIPE IS EQUIVALENT TO 2.0 MILES OF 23.3125" I.D. PIPE OR 656 MILES OF THE FIRST IS EQUIVALENT TO 200 MILES OF THE SECOND.
IN CASE THE STRAIGHT EDGE WHEN PIVOTED ON SCALE B AND CONTACTING WITH SIZE OF PIPE ON SCALE C DOES NOT INTERSECT SCALE A MULTIPLY OR DIVIDE THE READING ON SCALE B BY 10, 100, OR 1,000 TO FIND A CENTER POINT WHICH WILL GIVE AN INTERSECTION ON A. THEN READING ON SCALE A MUST BE DIVIDED OR MULTIPLIED (REVERSE TO THE OPERATION ON SCALE B READING) BY 10. 100, OR 1,000
EXAMPLE III
GIVEN, 200 MILES OF 23.3125" I.D. FIND EQUIVALENT LENGTH OF 15.50" I.D. THE FIRST INTERSECTION ON SCALE B IS 0.76 SAME AS ABOVE. BUT IT IS NECESSARY TO MOVE PIVOT POINT TO 7.6, WHICH, WITH STRAIGHT EDGE ON 15.50 INTERSECTS A AT 2.27. DIVIDING 2.27 BY 10 GIVES 0.227 MILES OF 15.50" I.D. EQUIVALENT TO 2 MILES OF 23.3125" I.D. OR 22.7 MILES OF THE FIRST HAS THE SAME CAPACITY AS 200 MILES OF THE SECOND.
A
LENGTH OF PIPE IN MILES
B
EQUIVALENT LENGTH OF 19.4375" I.D. PIPE IN MILES
C
I.D. OF PIPE IN INCHES
10.250
12.250
15.50
19.4375
21.375
23.3125
25.25
29.125
DEPARTMENT OF GAS CONSTRUCTION & OPERATION
PACIFIC GAS & ELECTRIC CO.
OCT. 8, 1931

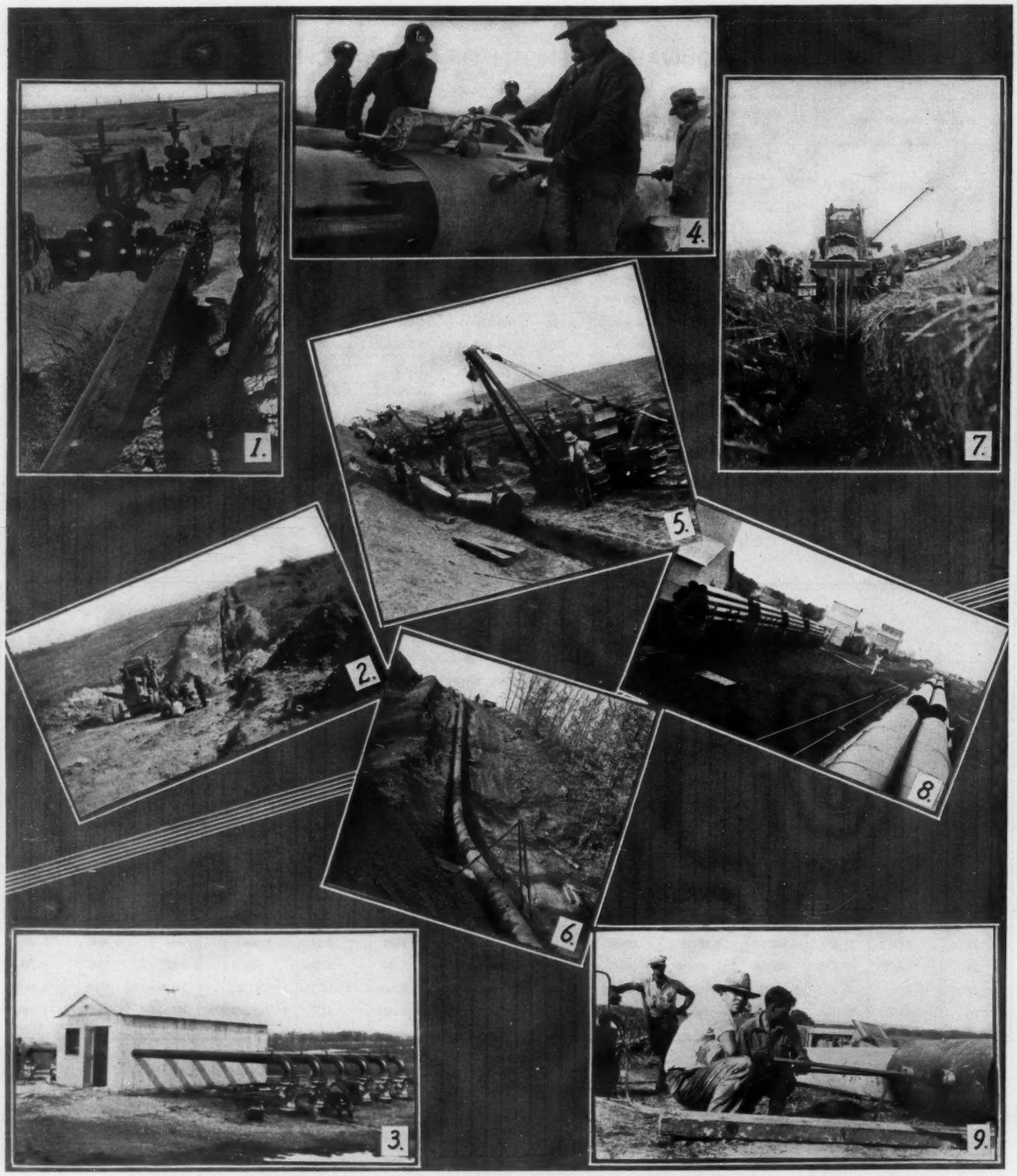
FIG. 6

TABLE No. 2—EQUIVALENT LENGTH OF PIPE 1/4-INCH TO 6 5/8-INCH

SIZE OF GIVEN PIPE			LENGTH OF FOLLOWING SIZES, EQUIVALENT TO A UNIT LENGTH OF THE GIVEN PIPE										
			PIPE						CASING				
O. D. Inches	Thickness Inches	I. D. Inches	1/4 Inch	1/2 Inch	3/4 Inch	1 Inch	1 1/4 Inches	1 1/2 Inches	2 3/8 Inches	2 7/8 Inches	3 1/2 Inches	4 1/2 Inches	6 5/8 Inches
1/4 Pipe	.088	.364	1.00000	17.414	76.03	282.8	1220.8	2779.8	10530.	29602.	95302.	464285.	3741893.
1/2 Pipe	.109	.622	.05742	1.000	4.366	16.24	70.11	159.6	604.7	1700.	5472.	26661.	214872.
3/4 Pipe	.113	.820	.013151	.22902	1.000	3.719	16.06	36.55	138.5	389.	1253.	6106.	49212.
1 Pipe	.133	1.049	.003536	.061583	.26889	1.000	4.317	9.83	37.23	104.7	337.	1642.	13233.
1 1/4 Pipe	.140	1.380	.000819	.014263	.06228	.23162	1.000	2.277	8.625	24.25	78.1	380.	3065.
1 1/2 Pipe	.145	1.610	.000396	.006264	.02735	.10173	.43919	1.000	3.788	10.65	34.28	167.	1346.
2 3/8 Casing	.154	2.067	.000095	.0016537	.007220	.026853	.11594	.26398	1.000	2.811	9.05	44.1	355.
2 7/8 Casing	.183	2.509	.0000338	.0005883	.002569	.009552	.041242	.09330	.35572	1.000	3.219	15.68	126.
3 1/2 Casing	.216	3.124	.0000105	.0001827	.000798	.002967	.012811	.02917	.11049	.31061	1.000	4.872	39.26
4 1/2 Casing	.148	4.204	.0000022	.0000375	.0001637	.000609	.002629	.00599	.02268	.06376	.20527	1.000	8.059
6 5/8 Casing	.203	6.219	.00000027	.0000046	.0000203	.000075	.000327	.00074	.00281	.00791	.02547	.1241	1.000

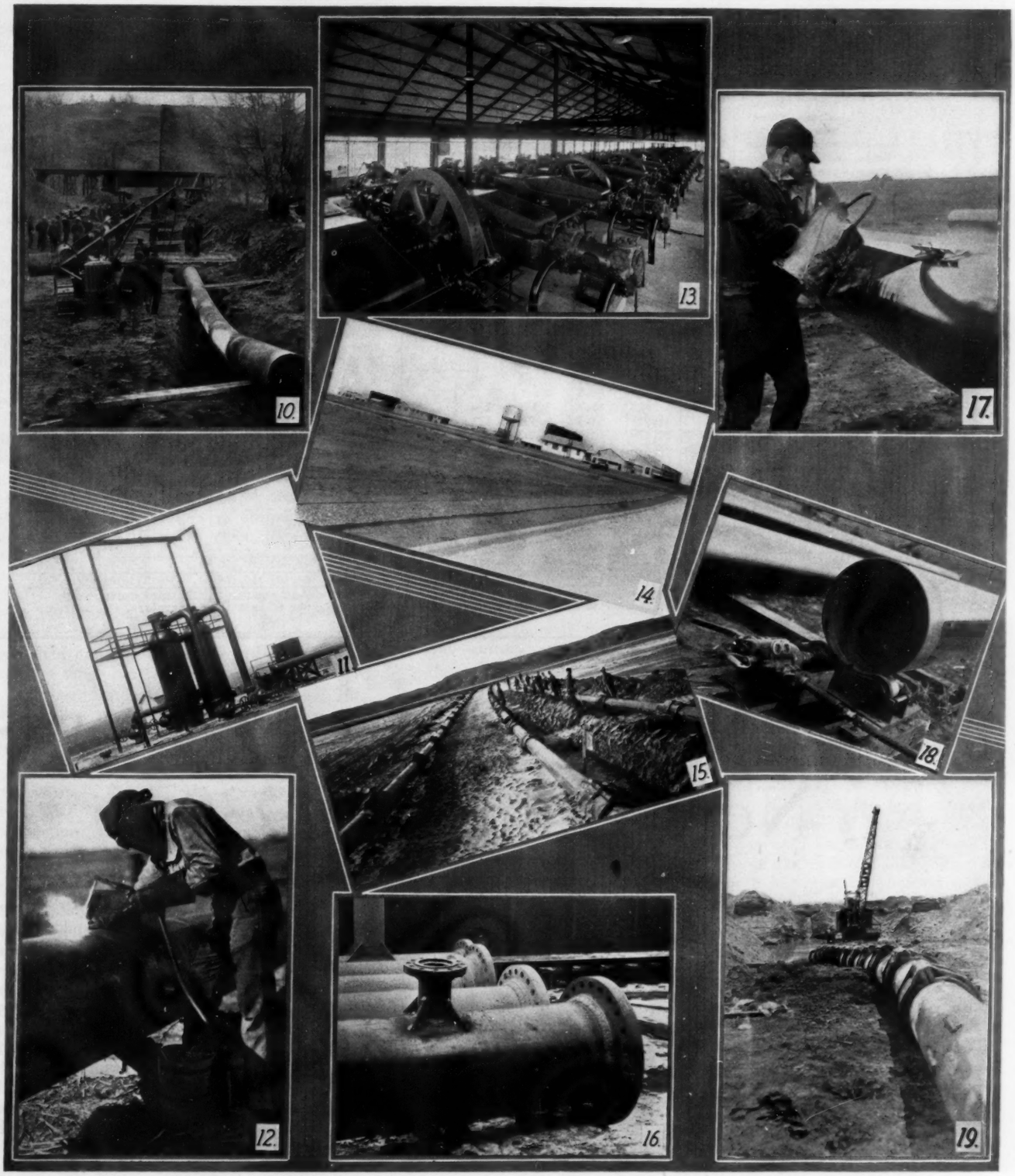
TABLE No. 3—EQUIVALENT LENGTH OF PIPE 4-INCH TO 30-INCH

SIZE OF GIVEN PIPE			LENGTH OF FOLLOWING SIZES, EQUIVALENT TO A UNIT LENGTH OF THE GIVEN PIPE										
O. D. Inches	Thickness Inches	I. D. Inches	4.204 Inches	6.219 Inches	8.191 Inches	10.250 Inches	12.250 Inches	15.50 Inches	19.4375 Inches	21.375 Inches	23.3125 Inches	25.25 Inches	29.125 Inches
4 1/2	.148	4.204	1.0000	8.509	35.075	115.983	300.096	1052.70	3520.60	5843.88	9282.75	14210.03	30428.97
6 5/8	.203	6.219	.1241	1.000	4.352	14.391	37.235	130.616	436.829	725.096	1151.783	1763.155	3775.56
8 5/8	.217	8.191	.0285	.22977	1.000	3.3067	8.5558	30.0127	100.3736	116.6109	264.654	405.133	867.54
10 3/4	.250	10.250	.00862	.06948	.3024	1.0000	2.5874	9.0762	30.3544	50.3855	80.035	122.518	262.356
12 3/4	.250	12.250	.00333	.0268	.11687	.3864	1.0000	3.5078	11.7315	19.4733	30.932	47.351	101.397
16	.250	15.50	.000949	.00765	.0333	.11017	.2850	1.0000	3.3443	5.5513	8.818	13.498	28.905
20	.28125	19.4375	.000284	.00229	.00996	.0329	.0852	.2990	1.0000	1.6599	2.637	4.036	8.643
22	.3125	21.375	.000171	.00138	.00600	.0198	.0513	.1801	.6024	1.0000	1.5884	2.4316	5.207
24	.34375	23.3125	.000108	.000868	.00377	.01249	.03232	.1134	.37926	.62954	1.0000	1.5308	3.278
26	.375	25.25	.0000703	.000567	.002468	.00816	.021118	.07408	.24775	.41125	.65325	1.0000	2.1413
30	.4375	29.125	.0000328	.000264	.001152	.003811	.009862	.03459	.1157	.19205	.30506	.467	1.0000



Materials and Methods on the Continental Construction

1. Walworth Sigma Steel main line gate valve connections at Perryton, Texas. 2. Parsons 35 trencher, digging on a 30 per cent grade near Peru, Iowa. 3. Meter station on main line at a point in Nebraska. Note Tube-Turns installed with single-vee welded joints. 4. Johns-Manville saddle-type machine applying paper wrapping in Iowa. 5. Two model PT-60 Cardwell Allsteel side-winches backstabbing a long sag-bend in 24-inch line in the sand-hills of western Kansas.—Bechtel Kaiser Co., Ltd., contractor. 6. A section of Dresser-coupled line taking a steep rise. 7. Buckeye Pipe Liner Model 48, digging a trench 32 inches wide by 6 feet deep at rate of 6 feet per minute. Note growth of fibrous roots. 8. A. O. Smith pipe ready for unloading at siding on section of line installed by Bechtel Kaiser Co., Ltd. 9. Heating pipe for bending.



Corp.'s 1,000-mile Texas-Chicago Natural Gas Carrier

10. 30-H. P. Caterpillar tractor with Allsteel winch, placing a section of hot bend pipe near Dayton, Iowa. 11. Dust separator at a main line compressor station. Tube-Turns seamless fittings used for pipe welding. 12. Operator using Lincoln Electric Co. Fleetweld electrodes, which utilize the shielded arc process. 13. Twelve 1,300 B. H. P. Worthington gas engines, 24x36 inch, at the Fritch, Texas, station, 15,600 H. P. station capacity. 14. Exterior of Fritch station. 15. Hand trenching in river bed of Canadian River. 16. Walworth 24-in. welded headers showing detail of weld for 800-lb. working pressure. 17. Pouring Wailes Dove-Hermiston Corp. bitumastic enamel near Peru, Iowa. Note use of metal pad. 18. Wailes Dove-Hermiston air-driven rolling rig. 19. Mud Creek crossing south of Anawan on Ford, Bacon & Davis section into Joliet, Ill. National Tube pipe, 18-in. used.

Summary of Natural Gas Statistics for 1930

State	Production			Consumption											
				Domestic (inc. commercial)			Industrial								
							Field (drilling, pumping, operating gasoline plants, etc.)		Manufacture of carbon black		Fuel at petroleum refineries, electric public-utility power plants, cement plants, and other industrial				
											Millions of cu. ft.				
	Quantity (millions of cu. ft.)	Estimated average value at wells per M cu. ft. (cents)	Average value at points of consumption M cu.ft. (cents)	Thousands of consumers	Consumption (Millions of cu.ft.)	Average value at points of consumption per M cu.ft. (cents)	Millions of cu.ft. (estimated)	Value (thousands of dollars) (estimated)	Millions of cu. ft.	Value at points of consumption (thousands of dollars)	Petroleum refineries	Electric public-utility power plants	Portland cement plants	Other Industrial	Value at points of consumption (thousands of dollars) [1]
Ala.	--	--	--	20	423	110.2	--	--	--	--	--	--	(2/)	2/732	$167
Ark.	18,585	5.5	19.0	66	8,338	48.3	13,455	$1,207	--	--	3,639	1,544	(2/)	2/11,255	2,046
Calif. ..	334,789	7.5	20.6	1,330	47,519	86.9	210,794	16,128	--	--	23,322	26,173	(2/)	2/26,981	11,626
Colo. ...	3,312	2.4	28.9	87	5,141	76.0	976	33	--	--	5	--	(2/)	2/10,520	1,507
Ga.	--	--	--	57	1,168	138.2	--	--	--	--	--	--	--	329	128
Ill.	2,890	8.3	17.5	13	115	102.6	2,806	235	--	--	149	--	--	6,532	1,323
Ind.	1,217	29.5	55.5	20	978	73.9	28	3	--	--	--	1	--	1,508	740
Kans.	37,630	7.9	33.1	186	17,320	58.4	10,490	1,182	--	--	4,526	12,636	9,649	21,014	8,044
Ky.	28,023	15.2	34.6	160	10,674	48.1	1,032	199	--	--	--	--	--	4,260	1,261
La.	278,341	3.0	12.9	128	8,574	59.0	22,408	1,055	85,226	2,395	13,699	18,557	--	35,632	7,719
Mich. ...	2,075	11.2	30.1	11	355	107.6	664	70	--	--	--	--	--	1,056	173
Miss. ...	179	5.6	48.0	16	684	92.6	6	0.4	--	--	--	239	--	806	196
Mo.	1,064	6.8	30.6	123	9,158	78.7	3	0.4	--	--	2,422	966	(2/)	2/13,573	3,120
Mont.	10,060	5.3	29.7	19	3,635	42.9	704	76	684	14	146	592	--	2,304	586
Nebr.	--	--	--	24	180	95.6	--	--	--	--	--	263	(2/)	2/ 655	178
N. Mex. .	9,497	3.3	13.4	6	428	61.7	3,142	134	--	--	4	250	--	111	100
N. Y. ...	9,624	32.1	66.8	273	16,915	68.3	499	171	--	--	200	25	--	1,352	957
Ohio	63,394	17.1	57.6	1,239	90,879	63.7	5,203	1,256	--	--	12	4,275	--	25,447	13,405
Okla. ...	348,116	5.1	13.7	236	28,206	48.8	248,870	16,255	(2/)	(2/)	11,664	6,678	(2/)	2/25,433	2/ 5,721
Pa.	88,706	29.0	50.2	637	51,974	61.4	6,290	2,091	--	--	1,121	62	--	48,771	17,780
S. Dak. .	98	8.2	32.7	5	1,172	56.0	--	--	--	--	--	--	(2/)	2/ 1,733	309
Tenn. ...	24	12.5	37.5	39	2,246	76.7	--	--	--	--	--	3,856	--	1,232	944
Tex.	517,880	3.6	13.9	522	41,058	66.1	163,506	15,404	176,418	3,441	25,792	43,885	11,162	64,339	24,697
Utah	393	2.0	31.3	19	1,067	77.5	--	--	392	8	--	--	--	2,586	425
W. Va. ..	144,180	18.0	46.2	173	23,824	36.9	13,379	2,871	(2/)	(2/)	1,653	94	--	2/23,932	2/7,053
Wyo.	43,219	3.7	9.9	15	3,517	40.6	18,908	747	(2/)	(2/)	10,488	194	--	2/7,112	2/1,104
Other ...	125	8.0	40.8	24	859	76.0	2	0.2	3,905	144	--	--	20,445	204	56
Total 1930	1,943,421	7.6	21.4	5,448	376,407	63.5	723,165	59,118	266,625	6,002	98,842	120,290	41,256	315,059	111,226
Total 1929	1,917,693	8.2	21.6	5,098	359,853	62.0	705,083	68,352	261,107	5,108	103,729	112,707	41,643	333,329	116,521

1/ Includes value of gas used at petroleum refineries, electric public utility power, plants, and cement plants. 2/ Included under "Other States" for United States total and under "Other Industrial" for State total to avoid revealing figures of individual operators. 3/ Revised.

Natural Gas Industry Records New Gains *in* 1930

By G. R. HOPKINS

Economic Analyst
United States Bureau of Mines

ALTHOUGH the natural gas industry in 1930 fell far short of repeating the expansion of 1929, it established a new high production record of 1,943,421,000,000 cubic feet. This represents an increase over the previous year of 1.3 per cent, which, though considerably below the average annual increase for the past decade, represents a creditable showing in view of the curtailment in the production of crude petroleum. Exports of natural gas to Canada and Mexico in 1930 amounted to 1,798,000,000 cubic feet, a material increase over the previous year. This resulted chiefly from increased deliveries to Mexico following the completion of the pipe line from the Jennings field in Texas to Monterrey. During the year, 21,000,000 cubic feet of natural gas were piped into Montana from Canada.

Adding the imports and deducting the exports gives 1,941,644,000,000 cubic feet as the total consumption within the United States in 1930. The number of domestic (including commercial) users of natural gas continued to increase and amounted to 5,448,000, a gain over the previous year of 7 per cent. This increase reflects the completion of the major part of the system from the Monroe-Richland field to Atlanta and the addition of numerous branch lines to existing systems. Although the average consumption per domestic user was less than in 1929, the proportion of the total consumption utilized for domestic purposes rose from 19 to 20 per cent and the percentage used for industrial purposes accordingly fell from 81 to 80 per cent, the same as in 1927 and 1928. The quantity of gas treated for the recovery of natural gasoline in 1930 amounted to 2,088,788,000,000 cubic feet, or 107 per cent of the quantity produced and delivered to consumers. The excess treated represents largely gas produced from oil wells which are so located as regards the fuel markets that the residue gas is valueless and is wasted. The average prices of natural gas at the wells continued to decline and in 1930 amounted to 7.6 cents per thousand cubic feet as compared with an average of 8.2 cents in 1929. This decline in natural gas prices at the wells was reflected in the prices paid by the largest users, the industrial consumers, who paid an average of 11.3 cents in 1930 as compared with 12.2 cents in 1929.

Total Production Up

The total production of natural gas in the United States during 1930 amounted to 1,943,421,000,000 cubic feet, an increase over 1929 of 25,728,-

000,000 cubic feet, or 1.3 per cent. This total does not include the quantity of gas blown into the air in flush oil fields.

Texas, the leading natural gas producing State in 1929, strengthened its hold on first place in 1930 when its output was 517,880,000,000 cubic feet, an increase over the previous year of 11 per cent. This gain was due principally to increased output from the Panhandle, the starting point for the majority of the large pipe line systems which originate in the State. Production in Oklahoma, the second-ranking State, showed a small decrease in 1930 as the decline in output of the Seminole district exceeded the gain in the Oklahoma City field. California also reported a slight decline in natural gas production in 1930; this resulted chiefly from the natural decline of the oil fields and the small number of new discoveries. Production in Louisiana increased in 1930 as an aftermath to the expansion of pipeline systems originating in the Monroe and Richland fields. Some of the States reported material declines in output of natural gas in 1930; the most notable were West Virginia and Pennsylvania, which ranked fifth and sixth, respectively. Production in Michigan in 1930 was less than half the 1929 total, evidence of the rapid decline of the Muskegon field and the failure of drilling to uncover other sources of supply.

Because of the curtailment in drilling, the number of gas discoveries in 1930 undoubtedly fell below the 1929 total. However, the number of gas wells completed was practically the same for the two years—2,866 in 1930 as compared with 2,870 in 1929. The total initial production of the 1930 completions probably constituted a new record as an increasing proportion of the wells was drilled with the object of establishing a gas reserve to insure the operation of the various large pipe line systems. The possibilities of Kentucky as an important source of supply were seriously considered and the number of gas wells brought in during 1930 was practically double the 1929 completions.

A substantial gas reserve was set up in the Hugoton field of southwest Kansas through the completion of approximately 80 wells in 1930. This field will be used principally as a supplementary source of supply for several of the pipeline systems running north from the Texas Panhandle. The Jackson field of Mississippi came in for considerable development work in 1930 and a number of very large wells were completed. This reserve will be used to supply the pipe line system running into Alabama and Georgia.

The completion of comparatively large wells near Tioga, Pa., and Dundee, N. Y. in 1930 greatly increased interest in the possibility of supplying New York City and New England with natural gas.

The total consumption of natural gas, computed by deducting exports to Canada and Mexico from the total of production and imports, amounted in 1930 to 1,941,644,000,000 cubic feet, an increase over 1929 of 1.3 per cent. The practice of storing gas in depleted sands in periods of low consumption progressed during the year but the amount stored in 1930 was not regarded as large enough to affect the consumption figures. Of the total consumption, 1,565,237,000,000 cubic feet, or 80 per cent, was consumed for industrial purposes, and 376,407,000,000 cubic feet, or 20 per cent, was utilized by domestic and commercial consumers. In comparison with 1929, these data indicate a slight growth in relative importance of the domestic consumption.

High-Lights *of* Natural Gas Totals *for* 1930

New high production record—1,943,421,000 M.c.f.—1.3 per cent over 1929.

Seven per cent gain in domestic consumers.

Addition of three states to natural gas users—raising total to 30.

Gain of 1,475 in number of producing gas wells—total now 55,020.

Gain of 17 per cent in quantity of natural gas transported between states.

Gain of 10,000 miles of natural gas trunk lines, as of July 1, 1931, over July 1, 1930.

Domestic Consumers Gain

The number of domestic consumers of natural gas showed a material increase in 1930, although the gain was much less than that experienced in 1929. The number of domestic consumers in 1930 amounted to 5,448,000, an increase over 1929 of 350,000, or 7 per cent. Beginning with 1930, the classification of domestic consumers was divided into two classes, namely, the strictly domestic or home users, and commercial consumers, such as stores and shops. The number of strictly domestic users amounted to 5,095,500, the number of commercial consumers totaled 352,680, a ratio of about 14 to 1. Three States, namely, Alabama, Georgia, and Nebraska, were added to the consuming States in 1930, which brings the total, exclusive of Alaska, to 30.

The total consumption of natural gas for domestic and commercial purposes in 1930 amounted to 376,407,000,000 cubic feet, an increase over the previous year of 5 per cent. The average consumption per domestic consumer continued to fall off and for 1930 amounted to 69,100 cubic feet as compared with 70,600 cubic feet in 1929. On the basis of the prevailing prices, each domestic customer paid an average of $4.39 for natural gas in 1930, as compared with an average of $4.38 in 1929. The increased cost in the face of a drop in the total used resulted from an increase in the average price.

The gas burned by domestic and commercial consumers in 1930 had a total value of $239,173,000, or an average of 63.5 cents per thousand cubic feet. This average price, the highest so far recorded represents an increase of 1.5 cents over 1929. The strictly domestic users paid an average of 67.4 cents per thousand cubic feet in 1930, as compared with an average of 46.8 cents for the commercial consumers. The highest price recorded for the strictly domestic users in 1930 was $1.417 per thousand cubic feet paid by consumers in Georgia; the lowest was $0.446 per thousand, paid by the Wyoming consumers.

The total consumption of natural gas for industrial purposes in 1930 amounted to 1,565,237,000,000 cubic feet, an increase over 1929 of .5 per cent. Of the total, 723,165,000,000 cubic feet, or 46 per cent, was used for field purposes; 266,625,000,000 cubic feet, or 17 per cent, was used in the manufacture of carbon black; 120,290,000,000 cubic feet, or 8 per cent, was burned as fuel by electric public utility power plants; 98,842,000,000 cubic feet, or 6 per cent, was utilized for fuel at petroleum refineries; 41,256,000,000 cubic feet, or 3 per cent, was burned at Portland cement plants, leaving 315,059,000,000 cubic feet, or 20 per cent, for miscellaneous industrial purposes.

The use of natural gas as fuel in the field was again the most important class of industrial consumption. The quantity so used increased from 705,083,000,000 cubic feet in 1929 to 723,165,000,000 cubic feet in 1930. This increase was somewhat surprising in view of the declines in drilling and in the production of natural gasoline. Oklahoma, California, and Texas, the three leading crude producing States, were the leading consumers of natural gas for field purposes.

The use of natural gas in the manufacture of carbon black, the second most

(Continued on Page 58)

A New Method for

Determining Ignition Velocity *for* Air *and* Gas Mixtures

By JOHN CORSIGLIA

Assistant Chief Engineer
American Gas Association Testing Laboratory

THE method for obtaining the ignition velocities of air-gas mixtures described herein was developed in connection with the Mixed Gas Research Investigation conducted by the A.G.A. Testing Laboratory, under the direction of the Mixed Gas Research Committee, of which F. C. Weber, assistant vice-president of the Brooklyn Union Gas Co., is chairman. During the initial phases of that investigation, it became increasingly evident that the chemical make-up of gases under study played a very important part in limiting changes in gas quality. This is true because of the effect of changes in chemical composition on ignition velocity. It is entirely possible to secure gases or mixtures of gases the heating value and specific gravity of which are practically identical, yet their burning characteristics may differ considerably, owing to differences in chemical composition. Again, if an attempt is made to compensate for variations in specific gravity by a change in heating value, where the heat delivery to a burner remains constant, changes in chemical composition may be such as to upset appliance operation. Furthermore, the effect of chemical composition on ignition velocity is so complex that it cannot be estimated, for the many gases likely to be encountered, except through a fundamental study. It was deemed essential, therefore, that a study of the ignition velocity of gases be carried along as a part of the Mixed Gas Research Investigation in order that a clearer and more comprehensive understanding might be had of the results secured. It was felt that information obtained from such a study would be particularly useful when a variation in gas quality involved changes in chemical composition. Moreover, complete data on ignition velocities should be of great value in the design of gas burners.

A survey of previous work on this subject disclosed a number of methods which are presented here in their essentials only. Two general methods have been used by other investigators in determining the ignition velocity of gases. These are the static method and the dynamic method. In the static method, the ignition velocity is determined from the time required for the flame to travel a given distance through a tube containing a known air-gas mixture at rest. In the dynamic method an explosive air-gas mixture is discharged through a small opening at such a rate of flow that the flame is just on the point of flashing back. Both of these methods are subject to considerable error and, furthermore, they do not reproduce actual conditions. A somewhat better method, first conceived by Gouy, employed the Bunsen flame. In a steady burning Bunsen flame the inner cone, sometimes called the "area of combustion," is in a state of dynamic equilibrium. When the flame is absolutely constant the ignition velocity is equal to the mixture velocity normal to the surface of the inner cone regardless of the size or shape of the inner cone. If the surface or area of the inner cone is known, the velocity of ignition can be computed from the rate of the flow of the air-gas mixture. Earlier investigators assumed the inner sections to be a perfect cone. A careful study of any Bunsen type gas flame will indicate that this assumption introduces considerable error.

More recently, a method employed by Pickering and Smith of the U. S. Bureau of Standards is based upon the assumption that the shape of the inner cone is determined by variations in velocity of the air-gas mixture at the burner port. It is assumed further that the average velocity will be found at points located 7/10 of the radius of the port from the axis of the port. Using these assumptions, the data taken from a photograph of the flame is the basis of subsequent computations. Another method is that developed by Stevens at the U. S. Bureau of Standards. The air-gas mixture under test is used to blow a thin-walled soap bubble at the center of which is located an electric ignition point. On ignition, a picture is taken with a moving film and the ignition velocity calculated. The last two methods are reported to yield results in substantial agreement. The latter, however, is intricate and somewhat tedious in its application.

It appears from a study of the above mentioned methods that the measurement of the inner cone surface should be most satisfactory, if for no other reason than that it most nearly represents actual conditions found with the ordinary gas burner. All methods of this type studied are based upon assumptions regarding the shape of the inner cone. In order to remove the possibility of error through such assumptions, the A.G.A. Laboratory devised a method of measuring the exact surface of the inner cone regardless of its shape. Briefly this method involves projecting a magnified image of a photograph of the flame on a frosted glass screen, tracing the projection of the inner cone in

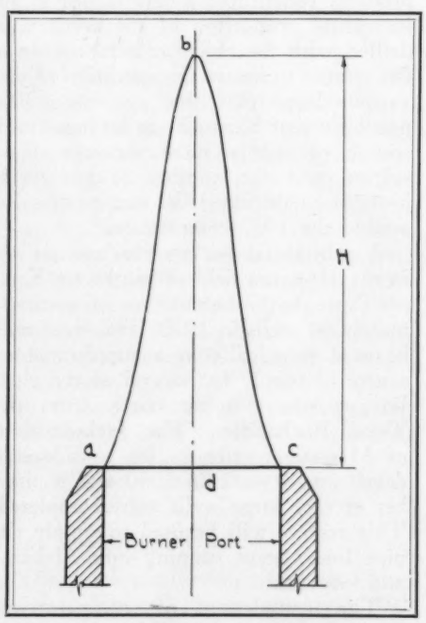


Fig. 1. Magnified projection of inner cone of flame.

pencil, and measuring the height, length of the side and area. These measurements make possible the calculation of the area of the inner cone without recourse to any assumptions as to its shape. The basis of the calculations is derived as follows:

The inner cone of a gas flame is represented in Fig. 1. The area a b c d represents a vertical cross-section through the center of the inner cone which has been magnified and projected on the frosted glass screen. If this area be represented by A, then $\frac{A}{2}$ represents the area c b d. The average distance of the side bc of the cone from the axis bd is $\frac{A}{2H}$. The surface of the magnified inner cone is equivalent to the surface generated by revolving the line b c of a length L about and parallel to the axis bd, using the distance $\frac{A}{2H}$ from the axis as the radius. If S represents the area of the surface of the magnified cone, then

$$S = \frac{2\pi A}{2H} \times L = \frac{\pi AL}{H} \quad (1)$$

Equation (1) represents the magnified area of the surface of the inner cone of the flame. If the image is magnified M times, the actual dimensions of the inner cone of the flame, as photographed, are:

$\frac{A}{M^2}$ = actual area of cross section of inner cone,

$\frac{H}{M}$ = actual height of the inner cone, and

$\frac{L}{M}$ = actual length of the side of the cone.

To obtain the actual surface area(s) of the inner cone as photographed, substitute the above values for the magnified values in equation (1) and,

$$s = \frac{\pi (A/M^2)(L/M)}{H/M} = \frac{\pi LA}{HM^2} \quad (2)$$

The area (A) is measured by a planimeter and is given in square inches. The height H is measured with a scale graduated to 1/100 of an inch, and is given in inches. A map measure, graduated to 1/32 of an inch is used to obtain the length L of the line bc.

In calculating the ignition velocity let,

u = ignition velocity, centimeters per second,

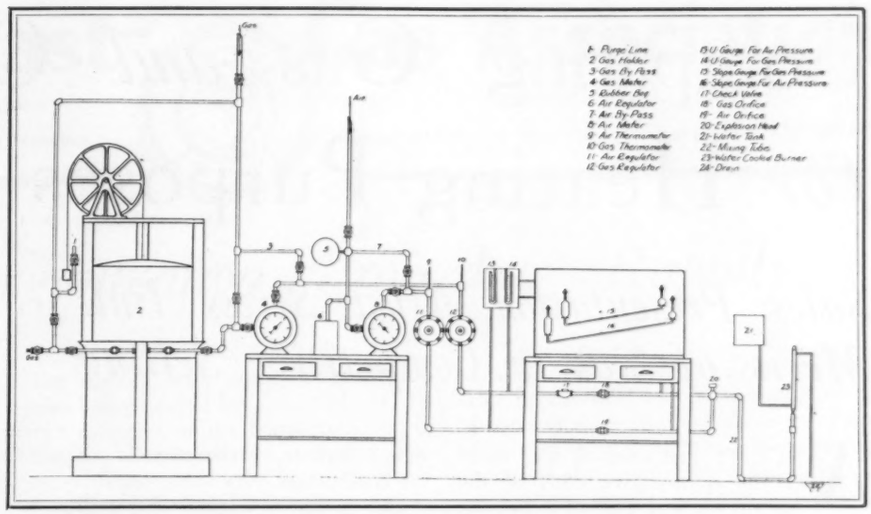


Fig. 2. Apparatus to control flow of gas and air.

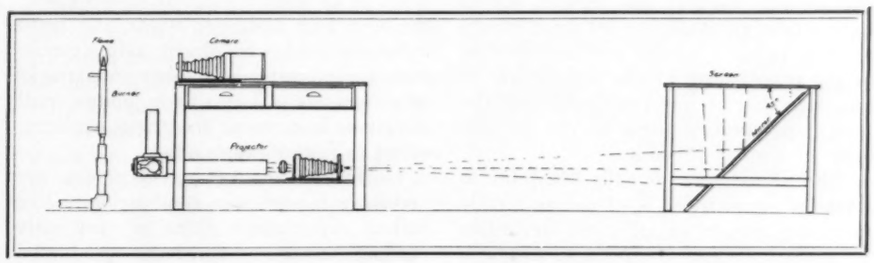


Fig. 3. Apparatus for photographing and projecting inner cone of flame.

V = total volume of air and gas mixture, cubic feet per hour,

$\frac{1728}{3600}$ = factor for converting cu. ft. per hr. to cu. in. per sec.

2.54 = factor for converting inches to centimeters, and

s = surface of inner cone, square inches.

Then the ignition velocity is

$$u = \frac{V}{S} = \frac{(2.54^3)(1728/3600)V}{(2.54)^2 s} = \frac{1.2192V}{s} \quad (3)$$

Combining equations (2) and (3)

$$u = \frac{1.2192\,V}{\pi LA/HM^2} = \frac{1.2192\,VHM^2}{\pi LA} \quad (4)$$

The following is a condensed description of the equipment used in obtaining the information necessary to compute the ignition velocity from equation 4. This apparatus is installed in a special test room in which the walls are painted dull black.

The arrangement of the apparatus used to control the rates of flow of air and gas is shown in Fig. 2. A 10 cu. ft. meter prover (2) was used for storage and mixing of gases to be tested. The crown of the prover was tapped and to it attached a vacuum line by which the crown could be completely evacuated when necessary. Two 1/10 cu. ft. wet test meters (4 and 8) were used to meter the air and gas respectively. Pressure regulators (11 and 12) were placed in the air and gas lines. In addition, two easily changeable brass plates (18 and 19), tapped for spuds with various sized orifices, were used to control the air and gas flow. Two differential gauges (15 and 16) having a slope of 6 to 1 were used to indicate the drop in pressure across the orifices. A check valve (17) prevented the air from backing up in the gas line and an explosion head (20) with a celophane diaphragm was used to prevent damage to the equipment in the event of flashback. Three interchangeable water-cooled burners, tapered at the top, were used. They were circular in cross section with internal diameters of 0.15, 0.25 and 0.356 inch. The kind of gas under study was the governing factor in the selection of the burner (23) to be used.

Fig. 3 shows the arrangement of apparatus used for photographing the inner cone of the flame and projecting the image on a frosted glass screen for measurement. The camera was used as

(Continued on Page 44)

Comparing Gas *and* Oil *for* Heating Purposes

By GEO. J. BURKHART
Industrial Engineer
Oklahoma Natural Gas Corp.
Tulsa, Oklahoma

Sales Presentation Must Stress Full Merits of Gas in Competitive Selling

A STUDY and analysis was made of the comparative costs of the use of oil and gas as a heating medium. The purpose of the study was to determine primarily the extent of competition natural gas service would have where an attractive oil price would tend to cause a loss of revenue because of the supplanting of the present use of gas with that of low priced oil, and the loss of prospective users of gas for the same or similar reason.

The adjustment of rate schedules to levels of competition is of course vitally necessary, but to adjust these structures to temporary and competitive prices is fallacious. If it is found that competition cannot be met, and a rate adjustment is necessary, the actual competitive prices should not entirely be the basis of any change. Investment costs should be such as to provide a margin for rate adjustment to meet public demand and regulatory requirements, but it appears reasonable to believe that commodities and services are purchased either as a result of sales activities, as in the sale of any article displayed in a merchant's store, or through self-established and self-evident superiority, such as good will, good service, ease of use, etc. To this extent it will be seen that with abnormally low oil costs and somewhat higher gas costs, the use of oil would be predominant, and the factor which should prevent the loss of a consumer is the convincing sales argument, the effective presentation of the advantages of gas —this argument to be such as to counteract the monetary differences which may exist.

In the use of oil the following items should receive attention:

1. Equipment
2. Method
3. Supervision

The fundamental principle involved in the use of any product for power or fuel, is the application of the proper mixture, ingredients or composition of the fuel, so that its use is made possible, and then its mixing in a properly designed burner, carburetor or chamber for combustion.

Oil in itself is combustible, but all harmful ingredients either must be removed or modified to make its use practical. Oil with a sulphur content will combine with hydrogen vapor and form sulphuric acid. Sulphuric acid deteriorates boiler plates and tubes and attacks other metals. Low flash points will sooner or later result in serious accident, either in fire or explosion.

Uniform and consistent grades are necessary for efficient combustion. The fullest expectations from oil are only realized from a constant, graduated supply, in which the percentages of the various elements are more or less constant. This is very necessary, as burners are generally adjusted for the use of uniform fuel, and unless this fuel be of similar material and grade, not only in individual barrels or shipment, but in the stream, a loss of efficiency is to be expected.

It is self evident that in the application of any carbureted fuel the proper mixture of the fuel with air or oxygen is necessary, and unless the burner is of such construction as to permit as efficient use as possible, a large monetary loss will be present, and in this connection the correctly designed burner should be applied at a larger initial cost, rather than a poorly designed burner at a lesser cost.

Another factor is the use of regulatory devices, and equipment for automatic operation designed to produce more efficient use of fuel. In the average commercial installation this factor is more or less ignored, with a consequent loss of combustion efficiency. It is therefore well to consider the fact that efficient burning of fuel oil cannot be expected unless conditions for its use are ideal, and that installations not equipped with efficient burning auxiliaries will naturally be less efficient in actual operation than general test results indicate.

It is well known that unless any operation is given a certain amount of supervision, the resulting product will be quite unsatisfactory, especially when periodic or spasmodic adjustments are necessary. Inasmuch as managers, supervisors and superintendents are responsible for economies and the maintenance of these economies, if responsibilities are delegated to inefficient subordinates or are predicated upon variable factors, in part uncontrollable, continued satisfactory results are quite impossible.

The following considerations must be given proper weight in determining relative fuel advantages:

1. Availability and use when needed.
   a. Gas is at all times ready for use at a moment's notice and requires only ordinary intelligence for its efficient combustion.
   b. Oil must be obtained through delivery and storage and requires preparation for its efficient combustion and constant attention of attendants.
2. Efficiency of combustion.
   The combustion of gas is more readily obtained to a high degree than oil under similar conditions of firing, and a higher degree of combustion is obtained with gas under adverse conditions such as laxness in boiler and furnace supervision, etc. The degree of combustion determines relative prices of fuel as consumed.
3. Variation of price and cost of fuel.
   a. Gas prices and costs are very stable and when changes occur the cost to the consumer is generally reduced and does not disrupt budget plans or cause undue increases in operation costs.
   b. Oil prices are very unstable and cannot be gauged to any degree of accuracy.
4. Purchase factors.
   a. Oil is generally bought on a volume basis. The quality of oil cannot be judged from appearances, and its uniformity must be diligently and closely followed through analyses. Most oils as delivered in barrel lots have 1-5 per cent of moisture and sludge and other waste materials, which, although not combustible, are included in the price.
   b. Delivery costs. The purchase price of oil is naturally composed of the sum of various costs, and delivery costs constitute a high percentage of the price as posted in the field.
   b'. Gas as delivered is at all times uniform in quality, is a perfect fuel, and is combustible to a very high degree.
   c. Handling costs. Oil must be handled before it can be used. It is a well known axiom that the less a commodity is handled in manufacture, delivery or use, the less its ultimate cost. Therefore oil increases in cost above purchase price because of the necessity for handling it.
   c'. Gas requires no handling.

(Continued on Page 54)

Pacific Coast Gas Association

Managing Director: Clifford Johnstone

Association Headquarters: 447 Sutter St., San Francisco

President: Jas. L. Stone

Vice-President and Gen. Manager, Spokane Gas and Fuel Co.

Committee Organization Proceeding Rapidly

THANKS to the splendid foundation laid during previous years and the foresight of President Stone in making early appointments to the important key chairmanships, the serious work of the Association's sections is proceeding into a new year with but little loss of momentum.

C. D. Cushman
Chairman
Accounting Section

F. M. Banks
Chairman
Commercial Section

The result of the intensive organization work which has been going on since the San Francisco Convention will be evident at the Organization Conference which, as noted elsewhere on this page, will be held at the Clift Hotel, San Francisco, on Thursday and Friday, November 19 and 20. The work of the Association's Sections and their committees is each year increasing in value to the industry and this annual Organization Conference is second only to the Convention in importance as it affords an opportunity to discuss timely problems and assign their study to interested groups.

Commercial Section Organization

F. M. Banks, chairman of the Commercial Section, announces the appointment of R. W. Coblentz, assistant general manager of the Washington Gas & Electric Co., Tacoma, as vice-chairman for the Northwest, and F. C. Packer, Pacific Coast manager of the Welsbach Co., as vice-chairman for the Central Region.

The Section will continue its organization into two principal committees, that dealing with domestic sales problems being headed by J. C. Gilbert, district manager of the Southern Counties Gas Co., Santa Monica, and that dealing with industrial sales under the chairmanship of E. M. DeRemer, industrial engineer, Southern California Gas Co., Los Angeles.

Mr. Gilbert plans some 12 sub-committees to study domestic sales problems. Included among these are a study of the vacuum heating system used so successfully by the British Columbia Electric Power and Gas Co. on commercial installations; an analysis of the load value of particular appliances; a study of air conditioning units and their possibilities under Pacific Coast conditions; continuation of the market survey which has thrown considerable light into the dark places at the last two Conventions; a survey of the extent to which gas companies are selling so-called promotional appliances, such as washing machines, dryers, ironers, incinerators, etc. and the possibilities in this field; a study of promotional or load building rates; an analysis of overhead unit heaters for commercial heating; continuation of refrigerator sales studies; employee education, and home economics. The development of the committee organization to study these timely problems is now well along and the personnel will be announced at the Organization Conference.

Also of interest to commercial men is the appointment by President Stone of a committee to study gas company merchandising as it concerns the retail dealer. This committee will report directly to the Board of Directors and Mr. Stone will act as chairman. Included in its membership are F. M. Banks, chairman of the Commercial Section, Geo. L. Myers, chairman of the Public Relations Section, and W. D. Thurber, chairman of the Publicity and Advertising Section.

W. D. Thurber
Chairman
Publicity and Adv.

Geo. L. Myers
Chairman
Public Relations

Organization Conference

Clift Hotel, San Francisco
November 19 and 20

Thursday, November 19

Committee meetings as specifically called by chairmen.

Friday, November 20

9:30 A.M. Section organization meetings Mezzanine Floor, Clift Hotel.

12:15 Noon Luncheon, Roof Lounge, Clift Hotel, followed by general program.

Detailed program will be mailed to all members early in November

Technical Section Program

D. H. Perkins, chairman of the Technical section, has appointed John Keillor of Vancouver as vice-chairman for the Northwest, and A. R. Bailey of Santa Cruz as vice-chairman in the Central Region. Guy Corfield, Los Angeles Gas and Electric Corp, will act as chairman of the Distribution Committee and F. F. Doyle, Pacific Gas and Electric Co., San Francisco, chairman of the Natural Gas Transmission Committee. The Distribution Committee will continue its studies of meters, pipe protec-

D. H. Perkins
Chairman
Technical Section

A. R. Bailey
Vice-Chairman
Technical Section

tion, distribution design, and regulators, and will add committees on accident prevention, store and toolroom practice, and the servicing of large commercial and industrial installations. The Natural Gas Transmission Committee will continue its work on large volume measurement, compressor plants, and pipe line construction and operation.

Public Relations Section

Miss Clarita Scott of Los Angeles has been re-appointed by Chairman George L. Myers to head the Women's Committee. Inasmuch as Miss Scott has received a similar appointment in the Pacific Coast Electrical Association, the work of the Women's Committee in both associations will be closely coordinated. It will be remembered that Miss Scott received an Honor Award from the Association for her excellent work as chairman of the Women's Committee last year. Daniel L. Scott of Los Angeles will continue as chairman of the Committee on Employee Education. Mr. Scott's committee held its initial meeting in Los Angeles on October 15.

Corrections in Burner Design Data

A VALUABLE paper on "Design of Gas Burners by the Use of Fundamental Flow Formulae," by Frank Wills of the Pacific Gas and Electric Co., San Francisco, appeared in the August, 1931 issue of *Western Gas*. Equations (61), (62), and (63) as there published were in error, the error in equation (63) affecting Table No. 5. The equations and Table No. 5 are published below in correct form.

$$A_2 \cong A_4 \sqrt{\frac{0.415}{\frac{f_3}{9}+2.69}} \cong A_4 \sqrt{\frac{3.74}{f_3+24.21}} \qquad (61)$$

$$A_1 \cong A_2 \frac{.74}{1} \frac{S}{S+R} \frac{1}{R+1} \qquad (62)$$

$$2.41 + f_3\left(\frac{A_2}{A_3}\right)^2 + 1.69\left(\frac{A_2}{A_4}\right)^2$$

$$A_1 \cong A_2\, 1.98 \frac{S}{S+R} \frac{1}{R+1} \qquad (63)$$

TABLE NO. 5—GAS BURNER DIMENSIONS FOR GASES OF VARIOUS DENSITIES AND HEATING VALUE

Calculated by Simplified Formulae

(For Only Certain Standard Shapes and Factors)

For More Accurate Figures Use the General Equations

		Symbol of Formula	Nat. Gas	Coal and Oil Gas	C.W. Gas	Propane	Butane
	Supporting Data						
1.	B.t.u. of gas		1180	550	550	2520	3270
2.	Specific Gravity	S	.65	.45	.60	1.5	2.0
3.	Flame Speed (Max.in 1"Tube) ft/sec.	F	2.3	5.5	6.0	2.7	2.7
4.	Theoretical Air Required	R_1	11.0	4.75	4.75	23.9	31.1
5.	Air-Gas Ratio in Burner	$R = .7\ R_1$	7.7	3.3	3.3	17.0	22.0
6.	Mixture-Gas Ratio	$R + 1$	8.7	4.3	4.3	18.0	23.0
.	Maximum Capacity Factor	$(R+1)/64F$	.059	.012	.011	.104	.133
8.	Cu.ft./hr. per sq.in. of port	$64F/(R+1)$	17	83	91	9.6	7.5
9.	Entrainment Factor	$\frac{S}{S+R}$ $\frac{1}{R+1}$	.009	.028	.036	.0045	.0036
	Burner Equations						
1.	Port Area, sq.inches	$A_4 =$	.059Q	.012Q	.011Q	.104Q	.133Q
2.	Ratio Manifold to Ports	$A_3/A_4 \geq$	Independent of gas used. Standard chosen = 2.0				
3.	Throat Area, sq. inches	$A_2 \geq$	Independent of gas used unless f_3 exceeds 1, see (61)			Use $A_2 = .39\ A_4$	
4.	Gas Orifice, sq.inches If f_3 does not exceed 1	$A_1/A_2 \leq$	.0178	.0554	.0713	.0089	.0071
			May be smaller to suit gas pressure if shutter is supplied.				
5.	Distance of orifice from throat		Probably independent of gas used See equation (41)				
6.	Piping Manifold		Independent of gas used. See equation (64)				
7.	Piping Manifold Feeder		Dependent on Specific Gravity of gas. See equations (59) and 59a)				
8.	B.t.u./Hr.per sq.in. port area at maximum capacity.		20,000	45,600	50,000	24,200	24,500

Second Line from Milpitas to San Francisco to Get Under-Way

Plans for the second line of the Pacific Gas and Electric Co. into San Francisco are progressing, with the route of the line being mapped and rights-of-way being secured. Fifty miles of pipe will be laid from Milpitas to San Francisco, the extension costing an estimated $2,000,000. The new carrier will be used to supply additional gas for domestic and industrial consumption in San Francisco.

Completes 10-Unit Compressor Plant on Los Angeles Line

Ventura Fuel Co., Los Angeles, Calif., on October 26 placed in operation its new compressor station near Somis Junction. The station, equipped with 10 175-B.h.p. units was constructed at a cost of $175,000, and will permit an additional 16,000,000 cubic feet of gas per day to be sent through the company's gas line to Los Angeles. This will bring the total delivery capacity to 70,000,000 cubic feet of natural gas daily for the Los Angeles area through Ventura Fuel Co.'s lines. The gas is sent out at an average pressure of 420 pounds. Between Somis and Ventura the pressure drops to about 350 pounds. The new Somis plant will boost the gas enroute to Los Angeles and send it on again at the original pressure of 420 pounds.

New Offices for San Diego Cons. Gas & Electric Co. at Escondido

San Diego Consolidated Gas and Electric Co., San Diego, Calif., has moved its Escondido headquarters to a new building on East Grand Avenue. The new office has 25 per cent more display space for appliances. Percy Fisher is district agent for the company at Escondido.

September Issue of Commerce Journal Devoted to Gas Industry

The September issue of the California Journal of Development was devoted to the activities of the Pacific Coast Gas Association and the Natural Gas Exposition, recently held at San Francisco. Feature articles by Clifford Johnstone, C. O. G. Miller, Addison B. Day, E. F. English, R. E. Fisher, A. B. Macbeth, Claude Brown and others gave a graphic picture of the gas industry on the Pacific Coast.

The California Journal of Development is published by the California State Chamber of Commerce.

New Mains at Wichita Falls

New mains are being installed by the Municipal Gas Co. at Wichita Falls, Texas, according to Jacob B. Price, district manager. The work will cost about $20,000.

Olsen to Head Oklahoma Natural; Deal Named to Board

E. C. DEAL, president of Oklahoma Natural Gas Corp. since July, 1931, has resigned that post to become chairman of the board of directors, and E. A. Olsen, for many months actively in charge of the management of the company as executive vice-president, has been named president. The

E. C. Deal *E. A. Olsen*

announcement of the change was made following a meeting of the directors of Oklahoma Natural.

Increasing responsibilities as president and director of numerous utility holding and operating companies throughout the United States under Tri-Utilities ownership, make the change necessary, according to Mr. Deal.

Mr. Olsen came to Oklahoma from California where he was operative vice-president of Pacific Public Service Co. The Pacific Public Service, through its subsidiaries, controls extensive gas properties on the Pacific Coast.

Mr. Olsen went to California in 1928, following many years of utility experience in various sections of the United States and particularly in the south, where he was executive vice-president of the Florida Power Corp.

1931-32 Calendar

November

Northwest Oil and Gas Association—Seattle, Wash., November 6-7, 1931.

American Petroleum Institute—Chicago, Ill., November 10-12, 1931.

Southwest Regional Gas Sales Conference, American Gas Association—Hot Springs, Ark., November 16-17, 1931.

Third Annual Conference on Bituminous Coal—Pittsburgh, Pa., November 16-21. 1931.

Pacific Coast Gas Assn.—Organization Conference, Clift Hotel, San Francisco, November 19-20, 1931.

December

Eleventh Annual Gas Meter Short Course and Conference—Under joint auspices of Mid-West Gas Assn. and Iowa State College. Ames, Iowa, December 8-11, 1931.

April

Missouri Association of Public Utilities—Annual convention, April 28, 29 and 30, 1932.

Second Southwest Natural Gas Sales Conference In Session Nov. 16 - 21

PLANS for the Second Southwest Natural Gas Sales Conference to be held at Hot Springs, Ark., November 16 and 17, are in the final stages, giving promise that the unqualified success met last year by the first conference will be paralleled in this year's sessions. Sponsored by the Commercial Section of the American Gas Association, the conference is taking its place as an annual event looked forward to by men of the industry in Louisiana, Texas, Oklahoma, Missouri, Arkansas, Kansas and New Mexico. The Arlington Hotel at Hot Springs has been chosen as headquarters for the Conference. Plans and program details were worked out at a meeting held there September 15 by the A.G.A. Southwest Regional Gas Sales Council, of which S. A. Lipscombe, sales manager, Little Rock Gas & Fuel Co., is chairman. There will be no entertainment features and no registration fee will be charged although delegates will be requested to register.

The Monday morning session, following the opening remarks and welcoming address, will feature papers and discussions on "Advertising for Future Sales" and "Holding and Developing the Industrial Load."

The Monday afternoon meeting will be presided over by Chester May, vice president and operating manager of the Community Natural Gas Co., Dallas, Texas. The session topic will be "Trade and Dealer Cooperation" and the papers will treat the following subjects:

"Developing Dealer Cooperative Sales Where Gas Company Merchandises."

"Promoting Sales Where Gas Company Does Not Merchandise."

"Advertising For Promoting Dealer Sales."

"National Trends in Dealer Cooperation."

Each address will be followed by a general discussion.

The session topic for the Tuesday morning meeting, presided over by W. Jennings Young, new business manager, Oklahoma Natural Gas Corp., Tulsa, Okla., will be, "House Heating By Gas," and will feature the following subjects:

"Central Plant House Heating In the Southwest District."

"Developing Floor Furnace Sales,"

"Promoting Other Forms of House Heating."

"Market Possibilities for House Cooling."

Tuesday afternoon, November 17, Sterling A. Lipscombe, sales manager, Little Rock Gas & Fuel Co., Little Rock, Ark., will preside, the session being a general one and including papers and discussions on the following topics:

"Selecting, Training and Organizing Sales Force."

"Reports from the Firing Line."

"Promoting Gas Refrigeration Sales."

"The Southwest Market for Gas Refrigeration."

As in the case of the other sessions, a general discussion will follow each paper or report.

The Southwest Regional Gas Sales Council of the Commercial Section, A.G.A., is made up of the following: S. A. Lipscombe, sales manager, Little Rock Gas & Fuel Co., Little Rock, Ark., chairman; J. B. Allison, industrial sales manager, Kansas Pipe Line & Gas Co., Salina, Kan.; Q. R. Dungan, gas engineer, The Empire Companies, Bartlesville, Okla., H. D. Ittner, commercial manager, Texas Public Service Co., Austin, Texas; W. Jennings Young, new business manager, Oklahoma Natural Gas Corp., Tulsa, Okla.; C. L. May, vice-president and operating manager, Community Natural Gas Co., Dallas, Texas; J. F. Orr, commercial manager, United Gas System, Houston, Texas; C. K. Patton, gas sales manager, Dallas Gas Co., Dallas, Texas; Elliott G. Peabody, sales manager, Baton Rouge Electric Co., Baton Rouge, La.; R. E. Sively, commercial manager, San Antonio Public Service Co., San Antonio, Texas; P. C. Tucker, manager, Arkansas Power & Light Co., Pine Bluff, Ark.; E. C. Whitcomb, Lone Star Gas Co., Fort Worth, Texas; C. B. Wilson, new business manager, Southern Cities Distributing Co., Shreveport, La.

Routing for Milwaukee Extension of Continental Construct'n Corp. Changed

Continental Construction Corp., Chicago, Ill., is acquiring the right-of-way for its 170-mile 20-inch line from the compressor station owned by the company at Geneseo, Ill., to Milwaukee, Wis. The line will extend northeast through Illinois to a point near Kenosha, Wis., thence north to Milwaukee, serving towns and cities on the route. Original plans called for routing the line from the Joliet station of Peoples Gas Light & Coke Co. to Milwaukee. Construction is expected to get under way without delay. Possibility that extensions may be laid to serve Rockford, Freeport and Belvidere in Illinois and Beloit, Wis., are mentioned in press reports from the district.

New Bulletins by Fisher Governor and Apex Regulator

Fisher Governor Co., Inc., Marshalltown, Iowa, in October brought from the press two new bulletins covering recent developments by the company, one of which describes in full the Konovalv, its structure and characteristics, the other the Fisher level controller or condensate drainer Type No. 327. Both publications are well illustrated.

Apex Regulator Co., a subsidiary of Fisher Governor Co., Inc., also announce the publication of several new bulletins covering the company's late developments, among them the MG Condensing Water Regulator, the Ammonia Back Pressure Relief Valve, the A.S.M.E. Standard Pressure Relief Valve, Ammonia Expansion Valves for commercial refrigerating systems and the Combination Pressure and Vacuum Relief Valve for gasoline and other oil storage tanks.

Copies of the above bulletins may be had by addressing either company at Marshalltown, Iowa.

J. E. Furneaux Division Manager for Community Natural at Handley

J. E. Furneaux, formerly manager of the Stamford, Texas, division of the Community Natural Gas Co., has replaced J. C. Reid as division manager at Handley, Texas. Mr. Reid resigned from the company to accept a position with the Mississippi Valley Gas Co. Mr. Furneaux was replaced at Stamford by William J. Buie.

The exhibition for the 1931 sessions of the American Gas Association Convention consisted of 241 booths covering a floor space of 70,060 square feet.

The Atlantic City Convention in Retrospect

By CRAIG ESPY

Eastern Manager, Western Gas

APPROVAL of the Five Year Program of the American Gas Association as practically applied by the several divisions of the Association during the past five years, and a continuation of this program for the succeeding five years, were voted by delegates attending the 13th Annual Convention of the Association at Atlantic City, October 12-16. Plans for continuing this work were outlined by Clifford E. Paige in his "President's Address" at the first general session, and may be summed up in the command to "Sell More Gas." Mr. Paige credited the active work of pipe line companies in extending service into new areas with contributing much of stimulus and enterprise to the industry during the current economic crisis.

Major Alexander Forward, managing director of the Association, in his annual report, stated that statistics for the first eight months of 1931 indicate a decrease of only a small percentage in revenues and gas sales for both manufactured and natural gas companies. Maintaining this equilibrium is recounted as phenomenal in the light of the peak records of 1929, and considering present conditions.

ELECTION OF OFFICERS

Election of officers, directors and committeemen for the 1931-1932 Association year also held a prominent place in the first general session. R. W. Gallagher, president of the East Ohio Gas Co., Cleveland, Ohio, was elected to head activities, as president for the coming year, while Arthur Hewitt, general manager, Consumers Gas Co., Toronto, Canada, N. C. McGowen, vice-president of the United Gas Public Service Co., Houston, Texas, and Howard Bruce, chairman of the Board, Bartlett Hayward Co., Baltimore, Md., were elected vice-presidents. William J. Welsh, vice-president and general manager, New York and Richmond Gas Co., Staten Island, New York, was elected treasurer.

New directors elected were F. S. Wade, president, Southern Counties Gas Co., Los Angeles, Calif.; B. J. Mullaney, vice-president, Peoples Gas Light & Coke Co., Chicago, Ill.; H. C. Abell, vice-president, Electric Bond & Share Co., New York; P. S. Young, vice-president, Public Service Electric and Gas Co., Newark, N. J.; Hermann Russell, president, Rochester Gas & Electric Corp., Rochester; C. N. Lauer, president, Philadelphia Gas Works Co., Philadelphia; F. C. Freeman, president, Providence Gas Co., Providence; F. A. Miller, chairman of the board, S. R. Dresser Manufacturing Co., Bradford, Pa., J. S. DeHart, Jr., president Isbell-Porter Co., Newark.

T. J. Strickler, vice-president of the Kansas City Gas Co., Kansas City, Mo., was elected chairman of the Natural Gas Department, with L. K. Langdon, general counsel, Union Gas & Electric Co., Cincinnati, being selected as vice-chairman.

The following were elected to the Management Committee of the Natural Gas Department: H. L. Montgomery, general manager, Cities Service Gas Co., Bartlesville, Okla.; Frank H. Brooks, president Missouri Valley Pipe Line Co., Omaha, Neb.; George E. Walker, president, United Natural Gas Co., Oil City, Pa.; N. W. Walsh, superintendent distribution and construction, Louisville Gas & Electric Co., Louisville, Ky.; John B. Tonkin, vice-president, Peoples Natural Gas Co., Pittsburgh, Pa.; William Moeller, Jr., vice-president, Southern California Gas Co., Los Angeles, Calif.

Presidents of all foreign gas associations were elected as honorary members of the A.G.A. during their terms of office in their own associations.

Atlantic City will be the scene of next year's convention, with October 10 being selected as the date for the opening of the Convention.

FEATURED ADDRESSES

The meetings were addressed for the large part by leaders of the gas industry, with an occasional talk from someone outside the industry. Among this last mentioned group of speakers were B. C. Forbes, editor of Forbes Magazine; Dr. Zay Jeffries, consulting metallurgist, Aluminum Corp. of America; Dr. Frederick W. Lee, supervising engineer, Geophysical Section, Bureau of Mines; G. Lynn Sumner, vice-president Advertising Federation of America; J. M. Watson, chief metallurgist, Hupp Motor Car Corp., and president of A.S.S.T.; W. D. McJunkin, president McJunkin Advertising Co.; and Arthur Pryor, Jr., of Batten, Barton, Durstine & Osborn, Inc. All of these with the exception of Mr. Forbes and Mr. Jeffries addressed the sectional meetings. These two, however, were featured at the general sessions.

The Natural Gas Department in its meeting heard the report of Chairman H. C. Cooper, vice-president and chief engineer, Hope Natural Gas Co., Pittsburgh, Pa., and a report by H. D. Hancock, gas engineer, Henry L. Doherty & Co., New York.

The Five Year Program was outlined at Wednesday's general session by D. D. Barnum, Boston Consolidated Gas Co., Boston, Mass., who is chairman of the committee.

RESOLUTIONS

Resolutions endorsing the new Five Year Plan and the enterprise of gas appliance and equipment manufacturers were adopted at the final session of the convention, the text of these resolutions being as follows:

"Believing that the Five Year program of association activities, adopted in 1926, has guided the industry well and served to concentrate our energies in the directions most essential to our progress, the American Gas Association in convention assembled heartily approves the new program prepared by the executive board for the succeeding five-year period.

"The American Gas Association again finds cause for gratification at the stability and adaptability of the gas industry of the United States and Canada, maintaining through a difficult period its service to the public, the soundness of its securities, the relative absence of unemployment, and expresses confidence in its future as an essential American industry.

"Our exhibitors at the 13th annual convention of the association have given the industry a vote of confidence, and have demonstrated their ability and purpose to produce and develop appliances and equipment for public use unsurpassed anywhere in efficiency or beauty, and the association hereby expresses its appreciation of their achievements and its confidence in our manufacturers.

"The association especially recognizes what our manufacturers have done by putting on the most comprehensive and most attractive exhibition ever seen anywhere. It is indeed refreshing to see, in these trying times, such a manifestation of the courage our associates have shown."

AWARDS TO A. G. A. MEMBERS

Two members of the industry were named to receive outstanding honors during the convention:

Theodore V. Purcell, vice-president of The Peoples Gas Light and Coke Co., Chicago, Ill., and chairman of the A.G.A. Committee on Domestic Load Survey, received one of the highest honors open to members of the gas industry when he was presented with the Charles A. Munroe Award for pioneering and constructive leadership in rate making; for focusing attention upon gas sales development and crystallizing the gas industry's economic policies to this end. The award consists of an engrossed certificate and $500 in cash.

The presentation took place at the evening session on October 14, and was made by Charles A. Munroe of New York, past president of the Association, who established this award.

In recognition of the best paper on a technical subject presented at last year's convention of the Association, Philip Thornton Dashiell, engineer of works of the Philadelphia Gas Works Co., Philadelphia, Pa., was awarded the Beal Medal, at the same session. The presentation was made by T. R.

Beal, president of the Central Hudson Gas and Electric Corp., Poughkeepsie, N. Y., whose family has donated this coveted award for years.

Mr. Dashiell won this distinction through his paper on "The Use of Heavy Fuel Oil in the Manufacture of Carbureted Water Gas," which was submitted last year before the Technical Section of the Association.

Total registration for the 1931 convention reached well over 5,000, and Association executives viewed this figure with a considerable degree of satisfaction, in the light of present conditions. Between 70 and 75 per cent of the total registration is estimated by officials to be that of gas company representatives, with the remaining percentage being credited to manufacturers and their attendants.

A total of 241 exhibit booths occupying 70,060 square feet of floor space were concrete evidence of the splendid cooperation of gas appliance and equipment manufacturers.

The time and place of the Natural Gas Department convention for 1932 is undecided and has been referred to a committee for further study. This uncertainty is brought about through the incompleted plans of the International Petroleum Exposition with which the Department hopes to meet in 1932, providing necessary arrangements can be made.

Among new committees appointed by the Natural Gas Department is a sub-committee of three men working under the measurement committee. This group will confer with a sub-committee of three of the Fluid Committee of the A.S.M.E. to review data on orifice meter coefficients to the end that the Association may publish coefficient tables satisfactory to both the American Gas Association and the A.S.M.E.

Another committee appointed is a subcommittee to the Main Technical and Research Committee which will collect data on large installations and uses of natural gas for industrial purposes.

Franchise of Western Service Corp. Extended Three Months

Western Service Corp., Oklahoma City, Okla., has been granted a three-month extension on its franchise to serve Appleton City, Mo., with natural gas. The company plans to lay 40 miles of pipe to serve that town as well as Montrose and Deepwater, Mo., with gas. Construction is expected to be complete before the end of the year, according to recent report.

Three Companies Applying for Natural Gas Franchise at Craig

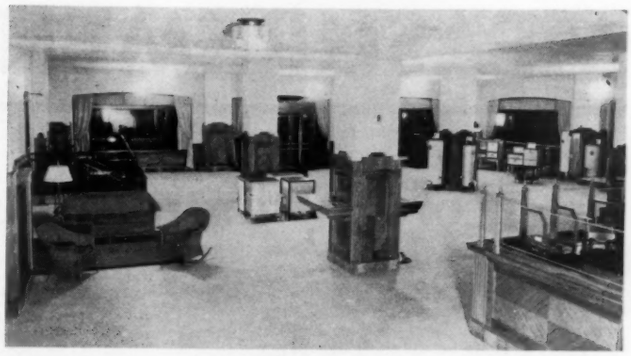
Three applications for franchises to serve Craig, Colo., are now filed with the board of trustees of the town. Ohio Oil Co., Casper, Wyo., is one applicant, Eastern Colorado Gas Co. another, and Colorado Gas and Utilities Co. the third. A special election will probably be called to decide the matter.

Adds 7,000,000 c. f. to Load Through House Heating Campaign

In a recent house heating sales campaign, extending from September 1 to October 16, the Coast Counties Gas & Electric Co.'s sales crews added a total of 7,090.000 c. f. to the company's yearly gas load. The company has approximately 18,000 consumers.

AT RIGHT:

Main office and sales floor of the new Oklahoma City office of Oklahoma Natural Gas Corp. A portion of the merchants gas appliance display may be seen.



Oklahoma City Office Opened Oct. 12

ON October 12, Oklahoma Natural Gas Corp., of Tulsa, Okla., celebrated the 25th anniversary of its founding with a formal opening of the new Oklahoma City offices of the company. The celebration lasted for two days, over 40,000 people having been invited to the festivities.

In mailing invitations to its customers in Oklahoma City, special attention was called to the interesting display of modern gas appliances arranged by local dealers in cooperation with the company. The new offices are established in the Key Building at Third and Harvey Streets.

Northern Natural Gas Company

Construction Operations as of October 1, 1931

State	Main Line	Branch	Total	Under Const.	Total
Texas	78	.....	78	.....	78
Oklahoma	47	.....	47	.....	47
Kansas	89	243	332	183	515
Nebraska	221	345	566	66	632
Iowa	206	152	358	40	398
Minnesota	.....	.....	.....	45	45
South Dakota	.....	.....	.....	86	86
Totals	641	740	1381	420	1801

Construction on No. Natural's System

CONSTRUCTION of major gas transmission lines by Northern Natural Gas Co., Omaha, Neb., continues at a rapid rate. Crews are active on a 420-mile front in Kansas, Nebraska, Iowa, Minnesota and South Dakota, and many miles of branch lines are being placed in service. Approximately 275,000 consumers are now being served by the company in 74 communities recently opened up for natural gas. There are between 45,000 and 50,000 meters in these communities.

The 16-inch line from Mason City, Iowa, to Owatonna, Minn., which is now under construction, is well over the Minnesota state line with nearly half of the line completed.

The 86 miles of 14-inch line from Sioux City, Iowa, to Sioux Falls, S. D. is well under way.

On the 183-mile, 26-inch line to Mullinsville from Clifton, Kan., less than one-third remains to be completed.

Sixty-six miles of branch line is being constructed in Nebraska to Wayne, Wakefield, Emerson, Adams, Wymore, Blue Springs, Elkhorn Valley and Waterloo.

Twenty-six miles of branch line in Iowa is being constructed to give natural gas service to Glenwood, Exira, Audubon, Dayton, Pilot Mound and Boxholm.

People's Natural Gas Co., distributing arm of the Northern Natural System, now operates in 12 eastern Nebraska towns and will soon begin operations in several other communities. The following distribution systems have been completed and natural gas service has begun: Auburn, Humboldt, Johnson, Pawnee City, Sterling, Tecumseh, Fairbury, Ashland, Elmwood, Louisville, Palmyra and Weeping Water. All of these towns with the exception of Fairbury are receiving gas service for the first time.

Federal Light & Traction Co. Reports Earnings Gain for 1931

Federal Light & Traction Co., New York, reports that for the 12 months ended August 31, profits of $2,901,202, were realized, as compared with $2,163,313 in the like period of last year, or a gain of $737,889.

International Acetylene Assn. To Convene Nov. 11-13

The Thirty-Second Annual Convention of the International Acetylene Association is scheduled to be held at the Congress Hotel, Chicago, November 11, 12 and 13.

MEASUREMENT and CONTROL

Recording Instruments in Gas Measurement

By W. C. Begeebing
Assistant Chief Engineer
*C. J. Tagliabue Mfg. Co., Brooklyn, N. Y.**

DESPITE its broad title, this paper will be restricted to recording instruments for flow, temperature, pressure, and humidity measurements.

All fluid meters, whether they measure quantity or rate of flow, consist of two parts —a primary element in contact with the fluid and a secondary element which converts the action of the primary element into volumetric or rate-of-flow units and records them suitably.

The standard of measurement of large gas volumes is the orifice meter, the primary element of which is the orifice plate and its connections. The secondary element of the orifice meter is the differential pressure recording gauge of which Fig. 1 is a typical example. In cross-section, this orifice meter is shown by Fig. 2 and several unusual features of its construction are revealed by this diagram.

An interesting arrangement has been employed to transmit the float movement to the pen, in place of the conventional bearing or stuffing box. A stuffing box must have friction because the friction prevents leakage. The novel construction illustrated in Fig. 2 eliminates stuffing box and friction entirely, and leakage is impossible because there is no opening in the walls of the differential pressure chamber. The float 45 rises and falls with changes in the rate of flow. The float movement is transmitted by lever 51, fulcrumed at 52, moving yoked member 67 up and down. Note how this member 67 is supported between the two tubular springs 65 and 68. These two springs may be likened to cups with flexible corrugated sides. The bottom of these cups are sealed into member 67 and the lips of these cups are sealed into the chamber wall. These two tubular springs oppose each other and the compression of the one is exactly balanced by the expansion of the other and vice versa. Thus their spring action cancels out entirely; yet they provide a flexible and sealed connection between moving lever and fixed case. Pen 59 takes this movement and transmits it to the recording pen 56.

The orifice meter shown in cross-section in Fig. 2 is designed either with the conventional differential pressure chamber with both legs having uniform cross-section and with a chart graduated uniformly in inches of water differential; or with a direct-reading chart which instead of having square-root or progressive graduations will also be uniformly graduated. This chart will, however, read directly in square root of differential pressure; i. e., in percentage of rate of flow. A uniformly graduated chart reading in square root of the differential pressure assures accurate and open reading anywhere in the range.

This uniformly graduated chart reading in square root of the differential pressure is achieved by progressively changing the cross-sectional area of the high pressure leg of the differential chamber. In this way a uniform float movement and a uniform pen movement is produced per equal increment of change in the square root of the differential pressure. These charts may be easily and accurately planimetered.

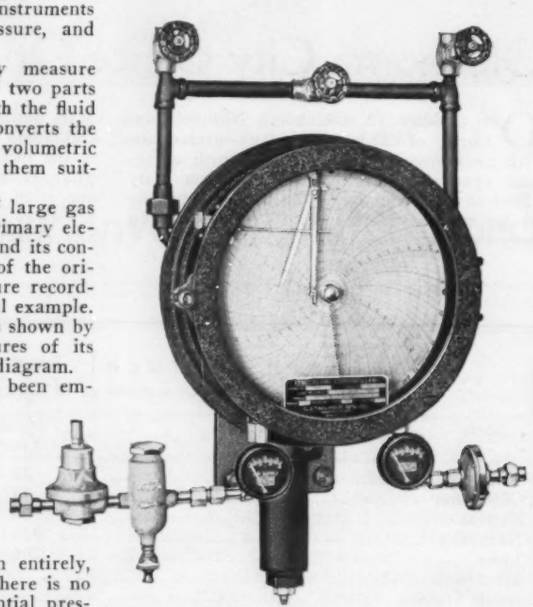


Fig. 1.

In this construction a definite volume of mercury must be used, and each meter bears a plate giving this quantity. The one illustrated, for example, requires 253 cc.

The question frequently comes up, "To what extent do temperature changes affect the accuracy of orifice meters of the float type using mercury?" A comparison of the cubical expansion of mercury (0.000099 per degree) and of steel (0.000017 per degree) works out to an error of less than 1/5 inch water pressure for a 60-degree change in temperature. The error cannot be minimized by a design using less mercury, for reduction in mercury volume also decreases the cross-sectional area of the chambers and the net result is the same. In the interests of best accuracy the meter should be shielded from excessive changes in temperature.

The desirable general characteristics of recorders, whether for flow, temperature or pressure, are obvious. Among them are the following: A sturdy case which is moisture, fume, and dust-proof. A dependable clock-movement with visible escapement and a starting device. Corrosion resistant pen-arm and pen-point, the latter with an adequate storage or fountain. In two-pen instruments the pens should pass, but the record lines should be as close together as possible to make lag between records negligible. The pen arms should have micrometer adjustment and pen-pressure adjustment. The charts should be printed on well-seasoned paper to obviate the circles becoming ellipses between printing and using. The pen arm should be pivoted on a fixed axis definitely assuring the penpoint coinciding with time arc on chart. Pen arms of two-pen recorders should be coaxial.

The spival or helical springs which act as the pressure element in pressure recorders and for the static pressure recording in orifice meters should be easily removable for replacement if injured or when a change in static range must be made.

The method of determining the hourly orifice coefficient has been thoroughly covered in the literature of the orifice meter. The coefficient is determined at a definite base pressure and a base temperature of 60° F. The value of the coefficient varies with the specific gravity of the gas and its absolute flowing temperature, and is of course affected by the meter connections.

The flowing temperature correction which in large volume measurement is quite important merits discussion.

Recording thermometers are used for this purpose, but at the technical sessions of the recent San Francisco convention of the Pacific Coast Gas Association some discouragement was expressed regarding the attainable accuracy under the conditions of use. Two points involving ambient temperature caused the most concern. First: The errors in the recording thermometer reading caused by temperature variations at the case and along the tubing. Second: The errors caused by the conduction effect on the bulb itself of the temperature of the union connection, and of the pipe wall. As one man aptly put it, "Am I measuring the temperature of the gas or of the pipe?" Both these points can be fully provided for, and with a properly selected and correctly installed instrument, the temperature can be recorded within an accuracy expectation of plus or minus one-half degree over a range covering 100 degrees.

For this service the choice lies between the mercury-actuated recording thermometer and the gas-filled recording thermometer. The mercury-filled is superior to the gas-filled in sensitivity (gas being inherently sluggish) and is also more accurate by virtue of its very rugged, powerful movement. Whereas in the gas-filled, the maximum pressure developed is only 300 or 400 pounds, in the mercury-filled, the maximum pressure is 2500 pounds per square inch contained in an all-steel tube system.

The mercury has another important advantage which takes care of the second cause of error mentioned above. Whereas in the gas-filled a relatively large bulb volume is needed, thus requiring that the entire bulb be sensitive, in the mercury type the sensitive portion is relatively short and is separated from the union connection by a dead extension piece. The short, sensitive bulb of the mercury recorder is tapered to fit the socket and the dead extension piece isolates it from the effect of the pipe temperature. The

* Read by A. L. Fickard, of The Braun Corporation, before the Southern California Meter Association, September 24, 1931.

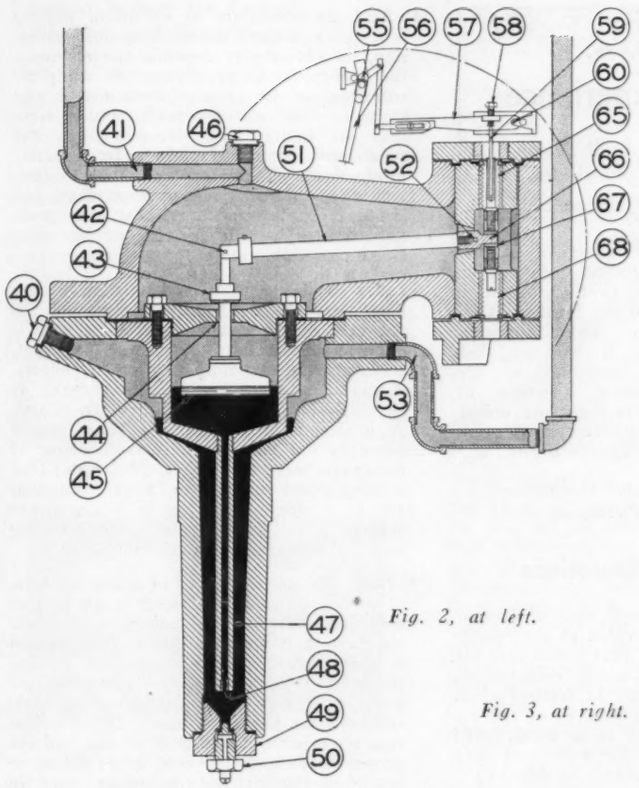


Fig. 2, at left.

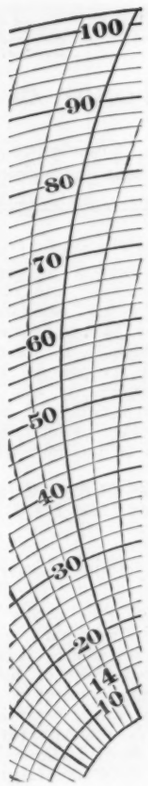


Fig. 3, at right.

length of the gas-filled bulb does not permit the use of a dead extension and precludes tapering the bulb, so that an air gap between bulb and socket wall adds to the inherent sluggishness.

With short lengths of tubing between bulb and case, either the mercury- or gas-filled recorder of standard construction can be used with negligible error due to temperature variations along the tubing. However, even with tube lengths as short as 20 to 25 feet, an error develops which may be a serious one if the record is applied to a correction of a large gas volume. The only positive assurance of accuracy is by the use of a fully-compensated construction. Fig. 4 shows the construction employed to compensate for this error.

This feature makes it possible to furnish mercury recorders with the tube lengths as long as 250 feet if desired. In this construction the regular mercury-filled capillary is surrounded by inert gas contained in an outer tube or jacket. The gas-filled space acts just like a long bulb (a bulb equal in length to the total length of the connecting tube) and this space or "bulb" is connected to a capsular spring D in the recorder case. This capsular spring automatically shifts the fulcrum C of (a) lever A up or down through (a) fixed fulcrum B connected to the main recorder spring, while connections F, G, C, H and K are floating. The change of the fulcrum position of the main mercury tube system mechanically compensates for the temperature fluctuations along the mercury tube systems of the mercury spring. In manufacturing fully compensated mercury recorders the test applied is to maintain the bulb at a uniform temperature and to coil up the entire length of tubing which is then immersed alternately in a hot bath and then in melting ice. This procedure in an uncompensated mercury recorder would induce extreme fluctuations in the temperature record, but does not change the bulb temperature indicated on a fully compensated recorder.

The relative humidity of gas is sometimes required and this can be very easily and accurately obtained by means of a wet and dry bulb type of recording thermometer. The mercury actuated type is favored, being used with 12-inch steel bulbs which are frequently silver-plated for this work. The important consideration in achieving true psychrometric readings is to obtain a sufficiently high gas velocity over the bulbs. The U. S. Weather Bureau figure for this is 15 feet per second. If this velocity is present in the gas main where the humidity recorder is to be installed, the most convenient arrangement is to mount the water box on a 6-inch or larger flange connecting the water box to a quarter-inch supply line through the flange. The wet-bulb and dry-bulb are also inserted through the flange and held by pipe-threaded union connections. If accurate psychrometric readings are wanted and the velocity in the gas line is too low, it is necessary to resort to a sampling line hook-up. A 2-inch sampling line with a special housing for the bulbs and water trough, and a ⅛-H. P. booster has been very successfully used on low pressure lines. Occasional removal and washing of the silk wick is necessary.

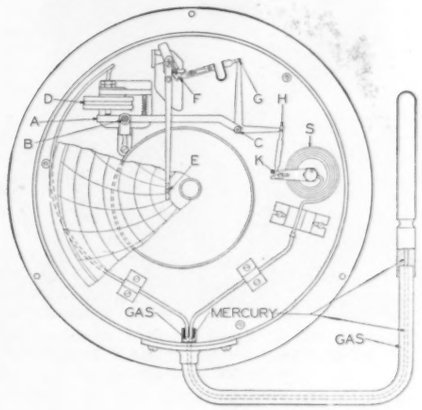


Fig. 4.

Eleventh Annual Meter Short Course, December 8-11

The Eleventh Annual Gas Meter Short Course and Conference held under the joint auspices of the Mid-West Gas Association and Iowa State College at Ames will be held December 8 to 11 inclusive.

Following a meeting of the committee in charge, it was announced that papers and discussions will deal largely with natural gas. Much of the territory included in the Mid-West Gas Association has received natural gas during the past year, or is scheduled for service some time in the near future.

Exhibits will cover distribution equipment which has been especially designed to handle gas under high pressure and measuring large volumes. All of this equipment will be explained and demonstrated by the exhibitors.

October Meeting at L. A. G. and E. Plant

PROGRAM and entertainment committees of the Southern California Meter Association combined their efforts to make the October 22 meeting of the Association one of the year's highlights. The meeting was held for the first time in the Los Angeles Gas and Electric Corp. plant at Ramirez and Aliso Streets, Los Angeles, where the annual S.C.M.A. Committeemen's Pep Meetings have been held for the past two years. A buffet dinner was served, and the informal surroundings made the occasion an enjoyable one for the 80 members and visitors present.

After routine business President P. W. Hill called upon R. F. Angell to lead a general discussion of the "Question and Answer" activities which the S.C.M.A. "Q. and A" Committee has under way. The first contribution from this committee appeared in this department of *Western Gas* last month, and new questions on measurement and control topics are found in the current issue.

Two excellent papers were on the October 22 program. T.K.M. Smith of the Industrial Fuel Supply Co. covered the subject "Pulsating Flow", with particular reference to a series of experiments which he has conducted recently. The paper was illustrated by strip charts from meters used in the pulsation experiments.

"Gas Dispatching" was the title of a talk by R. M. Bauer of the Southern California

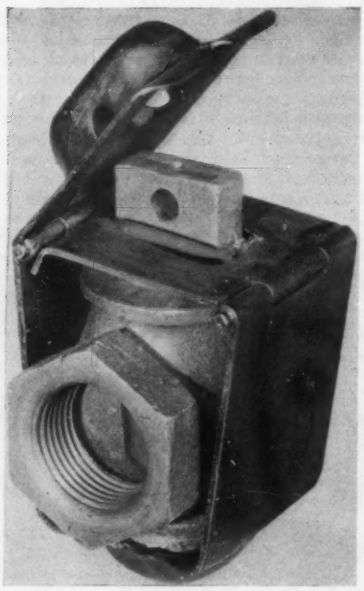
Gas Co., in which Mr. Bauer took his hearers through the many steps involved in bringing gas from the well head to the consumer.

Both of the above papers will appear in an early issue of *Western Gas.*

Caldwell Padlock Seal for Meter Shut-Offs is New Device

The Caldwell Padlock Seal Co., Dallas, Texas, announces production of a padlock seal for meters, for use either when the meter is not in service or when shut-off is made for non-payment of bills.

C. A. Caldwell, credit manager of the Dallas Gas Co., Dallas, Texas, is the inventor



The new Caldwell padlock seal for meter shut-offs.

of the new device, which had its origin at a chicken dinner with the wishbone as the inspiration. He adapted the wishbone shape to the seal, padlocked the open end and thereby invented a practical means of discontinuing service without removing the meter.

The Caldwell Seal was first put into use by the Dallas Gas Co. Other companies now using the seal are: Fort Worth Tex. Gas Co., New Orleans Public Service Co., Wichison Industrial Gas Co. of Wichita, Kan., and Connecticut Light and Power Co., of Hartford, Conn.

Altamont, Kan., Plans Election for Municipal Gas System

The town of Altamont, Kan., is planning to hold a bond election for the purpose of voting on the question of a municipally owned gas distribution system. Emmett Veeter of the Veeter Supply Co., Cherryvale, Kan., is asking for a contract to serve gas there at wholesale at the city gate. Supply would come from wells 10 or 12 miles north of Cherryvale.

Englewood to Have Gas Service

Kansas Pipe Line & Gas Co., Salina, Kan., is planning to establish gas service in Englewood, Kan.

S. C. M. A.
Forum of Experience

"Knowledge is built upon the experience of others."

ANY reader of this department is welcome to submit practical questions on measurement and control to the "Question and Answer" committee of the Southern California Meter Association. This committee, of which H. E. Thompson is chairman, each month propounds new questions in the "Measurement and Control" section of *Western Gas,* and answers them the month following. Send new questions, or your answers to questions which appear below, to

S.C.M.A. " Q. and A." Committee,
Box 1100, Sta. C, Los Angeles, Calif.

This Month's Questions

Q. 105. We notice a good deal of irregularity in regard to the value of the "acceleration due to gravity" that enters into the construction of orifice meter calculations. If this is taken as exactly 32, instead of its true value, what is the amount of the error?—V.G.M. (It pays to be forewarned of small irregularities for sometimes they multiply into large amounts of dollars.)

Q. 106. Does a bent pen arm affect the accuracy of a chart record?—W.W.M. (Ed. note: Not as easy as it sounds. The reason for the necessity of bending it comes into consideration.)

Q. 107. It is generally accepted that the pressure taps of an orifice meter set-up must be skilfully made (without burrs, etc.) and must be precisely located at 2½, and 8 pipe diameters from the orifice. Just how important is this, and why?—J.C.C.

Q. 108. If in installing an orifice meter, one is free to select whatever type of valves he wishes, what should determine his choice?—W.L.B. (Ed. note: Custom in this matter is certainly varied.)

Previous Questions Answered

A. 101. The error caused by eccentricity in positioning orifice discs shows as an increase in flow over that anticipated by the coefficient used. The amount of the error depends upon the relative amount of the eccentricity and upon the ratio of orifice diameter to pipe diameter. The question as asked cannot be directly answered, as each different set-up would require a different answer. If an appropriate coefficient were used, there would be no error. Such a coefficient may be produced by adding together the following three partial coefficients: One-half the regular coefficient for the orifice and pipe used; one-fourth the coefficient for the orifice in a pipe of larger diameter by twice the eccentricity; and one-fourth the coefficient for the orifice in a pipe of smaller diameter by twice the eccentricity. By comparing the coefficient thus produced with the standard coefficient, the per cent error may be established for any particular eccentricity of any given orifice. A few trial calculations will determine the allowable eccentricity for 1 per cent error.

A. 102. As chromium or cadmium plating is a precautionary measure against corrosion, its advisability depends entirely upon the probability of corrosion. At the present time, as the price of both monel and stainless steel are down, it would seem that the matter also depends upon the conditions of manufacture. In quantity production, plating of sheet steel discs would undoubtedly show a saving; but if only a few are produced at a time, probably economy would be attained by using a non-corrodable metal.

A. 103. It is quite impossible to state how many gas charts should be computed by one man in one day without some knowledge as to the man, as to the day and, mainly as to the simplicity of the charts. A maximum to expect might be taken as 60 single-pen charts or 30 two-pen charts. A minimum of 16 in eight hours would certainly not be an unfair requirement if the charts were reasonable. (Ed. note: One correspondent claims to have computed 100 in a single day; but it is significant that he did not state how much guessing was intermingled with the computing!)

A. 104. The measurement of pulsating flow of any kind by orifice meter is unsatisfactory and results in an indication of a lesser flow than actually exists. The reason is that in orifice measurement we use coefficients (which resulted from tests of flows that were not pulsating) which do not hold for pulsating flow. If the pulsation were without change, and you had the proper coefficient, the flow could be accurately measured; but pulsations vary in extent continuously, thus requiring a continuously varying coefficient; evidently a hopeless condition. The error in pulsating steam flow to pumps is sometimes over 25 per cent. It is partly due to disturbance of the *vena contracta,* any disturbance of which causes a larger effective diameter than the standard coefficients anticipate.

Monograph on "Warning Agents for Fuel Gases" Off Press

THE United States Department of Commerce, Bureau of Mines, and the American Gas Association announce the publication of Monograph No. 4, "Warning Agents for Fuel Gases," by A. C. Fieldner, R. R. Sayers, W. P. Yant, S. H. Katz, J. B. Shohan and R. D. Leitch. The paper presents the results of work done under a cooperative agreement between the Bureau and the Association, and was printed by the latter.

Since developments in the gas industry are tending toward increased use of less odorous types of gases, such as natural gas and mixtures of propane and butane carbureted with air, as well as blends of natural and manufactured gas, the problem of odorization has assumed greater magnitude. In view of the relation of this problem to public safety and the conservation of fuel, and considering the experience which the U. S. Bureau of Mines staff has had with physiological research on industrial gases, the Bureau undertook the problem of making the investigation with the assistance of the American Gas Association.

The investigation was conducted by a mutual agreement made in 1926 between the two bodies, renewed in 1927, 1928 and 1929 with corresponding appropriations by the A.G.A., totaling approximately $20,000.

The Bureau was assisted in conducting the investigation by a committee of gas engineers and chemists appointed by the A.G.A. under the chairmanship of W. H. Fulweiler, chemical engineer of the United Gas Improvement Co., Philadelphia, Pa., with J. W. West, Jr., of the Association as secretary.

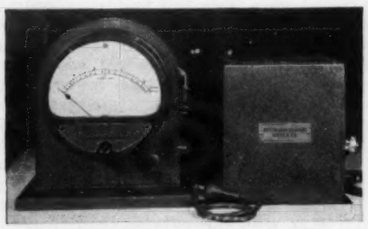
Telemco System for Remote Indicating and Recording

THE Pittsburgh Equitable Meter Co. announces a means for remote indicating and recording through the use of the Telemco System.

The purpose of the remote indicating device is to measure or indicate a quantity or magnitude, such as gas pressure, water level, oil pressure, energy, flow and the like, at a point remote from the locality at which such a quantity or magnitude exists.

The Telemco System consists of a transmitter and a receiver, the transmitter to be placed where the measurement is to be taken and the receiver where this measure is to be indicated or recorded.

Two connecting wires only are needed between the transmitter and receiver, and in many cases where the distance is not too great a single wire with ground return may be used.



The new remote indicating device manufactured by Pittsburgh Equitable Meter Co.

The current used is 10 milliamperes at 35 volts. Power is required only at the receiving end. This is an advantage in cases where it is desirable to install the transmitter in manholes or other places where a current source is not available. It is impossible for sparks to occur at the transmitter since there are no brushes or contacts.

According to the manufacturer, there is practically no limit to the distance over which the system may be used.

The device consists of a vacuum tube, a milliameter, a fixed resistance, a variable inductance and a static voltage regulator. It is not influenced by currents which might be induced in the line by extraneous influences, such as nearby high tension transmission lines. The system is said to maintain its accuracy to within 2 per cent even if the supply voltage drops to 20 per cent below normal, or rises 15 per cent above normal.

Among other applications Telemco Systems are designed for use by gas companies in the measurement of pressures maintained at outlying points of their distribution systems, namely at holders, reduction points, pipe line entrances to large industrial plants, pressures along long distance transmission lines, also for the measurement of heights of holders, indications of positions of valves, etc.

They are employed also in central heating plants for the remote recording of steam pressures maintained at distant points in the system.

Garman Resigns as Manager of Union Oil Gas Department

R. W. Garman has resigned as manager of the gas department of Union Oil Co. to engage in private practice as consulting engineer. R. E. Haylett will take over the duties of the position.

Meeting the Attack on Merchandising

(Continued from Page 16)

the local merchants carry but a limited stock, if any, of modern gas or electric appliances, the percentage may rise as high as 40 per cent of the total sold. The experience of the Southern Counties Gas Co. of California is that less than 20 per cent of the gas appliances supplied in the territory served by it are purchased from the gas company; the rest is supplied by the local dealer. For example, in the Santa Monica Bay District this utility sold, in 1930, only 18 per cent of the gas water heaters installed; in Pomona, 11 per cent of the water heaters and 13 per cent of the gas stoves; in Santa Barbara, 14.6 per cent of the water heaters.

The retail trade organizations recognize the value of the pioneering work done in the past by the utilities, but they feel that most homes are now fully equipped with gas and electric appliances, and that the local dealers can now be left to carry on the sales work alone. This is the great fallacy that forms the basis of the argument of those who would legislate the utilities out of the appliance business. We insist, however, that there still remains an enormous amount of pioneering work to be done by the utilities. The gas refrigerator we know is but in its infancy. The electrical industry is still confronted with a large undeveloped field. The Southern California Edison Co., Ltd., for instance, serves approximately 400,000 domestic meters; yet only 27,000 homes have electric ranges—or a fraction under 7 per cent, and only 6,000 homes have electric water heaters, or 1½ per cent. The work of pioneering new and improved appliances will never end.

The natural gas industry in California has a particularly difficult problem. In wintertime when the homes are largely heated by gas appliances, the peak demand on cold days for gas is very great, exceeding the summer demand three and four times in amount. The gas companies, however, have to build facilities and contract for supplies of gas to take care of this peak demand, even if it exists for but a single day. Manifestly, the gas utilities have to exert a tremendous effort to find and develop a market for their surplus gas during the remainder of the year; otherwise the cost of gas would be unreasonably high. To develop this demand for gas, the utilities make an intensive survey constantly to ascertain every possible use for gas as a fuel. Their engineers study the problems of all classes of industries in order to devise types of appliances that will suit the needs of these industries and enable them to use gas as a fuel. As a rule there is not available on the market, carried by any dealer or appliance house, burners or equipment suitable for the use of many of these industries. The gas companies, in their research laboratories, have to design and build types of burners and equipment for the use of these industries, install them, service them, improve them, and at great expense ultimately perfect appliances that are attractive and useful. This is a type of pioneering work that no one else but the utility could do or could afford to do. It is work that is of extreme benefit to industries, and it results in benefit to all gas consumers through the utilization of gas during the off-season periods, making possible lower rates to the domestic consumer for the entire year.

The Southern Counties Gas Co. of California, supplying all of the communities in Orange County, Ventura County, Santa Barbara County, and most of the suburban territory in Los Angeles County, has in the past 10 years done a vast amount of this pioneering work, inducing scores of industries to utilize gas who had never before even contemplated the advantages of such a fuel.

Let me give an example of the kind of work we have done and must continue to do. In Southern California large amounts of chili peppers are grown. Not many years ago these were prepared for market consumption by drying in the sun—a slow and unsatisfactory process. The engineers of the gas company conceived the idea of drying these papers by using natural gas as a fuel. The plan was laid before the people engaged in the chili pepper business. No manufacturer even made the type of appliance that would be required. Our engineers had to invent, build, install and service the equipment that would do the work and secure this outlet for gas. The problem was successfully solved by the gas company's engineers, and a beneficial result obtained. Similar pioneering has been carried on with respect to beet pulp drying, treatment of walnuts, and scores of other agricultural activities. It was work that never could have been accomplished except by the gas companies.

The retail trade organizations claim that the utilities should do the work of advertising, soliciting and stimulating the consumer demand, and then leave it to the local dealer to sell the appliance. The Western Furniture Conference, at its convention last July, in its resolution stated that: "Whenever they have been permitted to do so, retail dealers have invariably shown an ability to do a better merchandising job than can be done by the utilities." Our experience, however, over many years, proves that the problem of making the ultimate sale cannot be left alone in the hands of the local dealer. Anyone familiar with the elements of salesmanship knows that it is folly to work a prospect up to the point of buying a commodity, and then turn him loose on the streets to find the commodity of his own volition.

Even the most rabid among the opponents to utility merchandising, concede that the utilities must and should keep up their advertising and promotional work—but the making of the ultimate sale, it is claimed, should be left to the local dealer. Outside of all other considerations, it is difficult for me to see how, from a practical standpoint, this could be done without creating conditions far worse than those now complained of. For instance, if the engineers of the utility should interest an industry in the installation of gas-burning appliances, shall they leave the customer to go out and select the type of appliance that may suit his fancy, or shall they direct him to some particular type of appliance which they know to be the most efficient; and if the utility engineers direct the consumer to any given type of appliance, what particular merchant shall they pick out as the one to be favored with the order? It is clear that such a plan would result in favoritism and abuses too numerous to mention.

I am firmly convinced that a gas utility cannot properly develop its potential market unless it engages actively in the merchandising of gas-burning appliances. The installation of new appliances is the load-building factor that cannot be overlooked by

the utility. Let me give you one simple illustration. In Orange County 21 customers of the Southern Counties Gas Co. used, between March, 1926, and March, 1927, a total of 1,054,500 cubic feet of gas—an average of 50,214 cubic feet per consumer. A modern automatic storage gas water heater was placed in the homes of these 21 consumers during March of 1927. These same consumers, with better hot water service, used, between March, 1927, and March, 1928, a total of 1,380,800 cubic feet of gas, or an average of 65,752 cubic feet per consumer—an increase of 30 per cent in gas consumption due to the installation of but one additional gas-burning appliance in each home.

Deprive the utilities of the right to merchandise gas and electric appliances, and their growth and development will be retarded, to the detriment of the public at large.

The Proposed Legislation Is Unwise in That It Would Cripple All Utilities in Rendering Good Service to the Public

Neither gas nor electricity is of any advantage to the consumer unless it can be successfully utilized through some form of appliance. The independent dealer is not concerned with whether the appliances in which he is dealing, be they gas or electric, are the most effective appliances that it is possible to obtain. The independent dealer is interested solely in the profit that he can make from the sale of an appliance. The utilities, on the other hand, are concerned primarily with affording to the public the best known and most economical type of appliance. The gas and electric industry of this country, both through national and local organizations, maintains extensive laboratories for the purpose of constantly studying the problem of not only improving all existing types of appliances, but of inventing new and additional appliances. As fast as improvements are discovered or new types of appliances designed, pressure is brought to bear upon the manufacturers of appliances to compel them to construct these improved appliances. As fast as the new gas and electric appliances are produced, the utilities make them available to the public by offering them for sale in their appliance departments. The fact that the utilities have at all times the latest and best types of appliances on sale, forces the independent dealer to raise the standard of the appliances sold by him. If the utilities are denied the opportunity of forcing the sale of these new and improved types of appliances, it will mean that the dealers will continue to sell the poorer and cheaper types of appliances which yield them perhaps a larger net profit, but are not as satisfactory or as economical from the standpoint of the consumer.

The manufacturer can not afford to bring out a new appliance unless assured of a market. The local dealer, as a rule, is seldom willing to risk his capital in new and untried merchandise. The utility is the medium through which the manufacturer can establish his product, and once it is established and a consumer demand created, the local dealer is willing to handle the article. Without the support of the merchandising utility, the manufacturer is practically precluded from venturing forth with new and improved appliances. It is safer for him to stick with the old appliance. Does anyone feel for one moment that the new gas refrigerator can ever be established on a parity with the popular electric refrigerator if the merchandising of this new gas appliance is left solely in the hands of the local dealer?

The gas utilities must keep uppermost in their minds the fact that what they are selling is gas service. The public are little interested in the quality of gas, but they are vitally interested in the manner in which the gas service is rendered; and the consumer judges his gas service by the results obtained from the appliance through which he utilizes the gas. Our duty to the public, therefore, is not fully discharged until we have furnished the public with a suitable gas-consuming appliance, and the more enterprising a gas utility, the more concerned it is with seeing that its consumers are furnished with the most modern, the most economical, and the most efficient types of gas-burning appliances.

Deprive the gas utilities of the right to merchandise appliances, and you will deprive the utilities of the principal leverage through which they are enabled to compel the local dealers to handle the best and most economical types of gas-burning appliances.

The Proposed Legislation Is Economically Unsound in That It Would Inevitably Result in Increasing the Cost of Utility Service

Anyone familiar with the gas business, especially the natural gas business as it is carried on in California today, knows that the cost of gas delivered to the domestic consumer decreases as the volume of use of gas increases. The small, or so-called minimum, consumer of gas is carried at a loss—an absolute out-of-pocket loss—by the gas utility. This loss in turn is borne by the average and by the larger consumer. Anything, therefore, that can be done to stimulate increased use of gas—and the same is true of electricity—brings down the average cost of all gas and electricity delivered to the domestic consumer, and hence results in a public benefit, through decreased rates.* Any legislation which would cripple the gas utilities in building up their volumetric sales is distinctly against the interests of the general public.

During the past 15 years the gas service in most of the towns in California has been changed from artificial to natural gas. Due to the fact that natural gas has twice the heating value of artificial gas, the result of making the switch from artificial to natural gas is to cut almost in half the volume of gas used by each consumer. In order to maintain its earnings, the gas company has to either increase its rates or build up the volume of gas consumption. The former is unpopular with the consumer; the latter is the sounder and fairer way of meeting the situation. The gas companies, therefore, have been under the necessity of conducting the most intensive campaigns in order to induce consumers to use more gas, and this increased use of gas can only be obtained by inducing the consumer to buy and install new and improved gas-burning appliances, and it is only through the active merchandising of these appliances that the gas load can be increased, and low gas rates maintained. The ultimate gas consumer is the one who benefits directly from this merchandising activity on the part of the utilities.

During the past 10 years practically every other type of commodity has increased in price from year to year. Gas and electricity are among the few exceptions to this rule, and the present low rates are very largely due to the strenuous efforts made by the gas and electric companies to increase the average use of these commodities.

*To this presentation was attached a study showing the average domestic rate and the annual unit consumption of gas on the system of the Southern Counties Gas Co. of California during the past 10 years—illustrating graphically how the rates for natural gas decline as the unit consumption increases in volume.

The Proposed Legislation Is Unnecessary for the Protection of the Legitimate Interests of the so-called Independent Dealer

General experience proves that vigorous merchandising by the electric and gas utility companies on a recognized merchandising basis, actually stimulates and increases the volume of business accruing to the local merchant. To substantiate this claim, we procured, within the space of three or four days, and presented to the Public Utilities Committee of the California Senate, letters from 116 merchants, plumbers and tinsmiths in Southern California, all to the effect that the promotional and advertising work done by the public utilities in Southern California had stimulated the demand for gas and electric appliances, and had resulted in increased sales for these local merchants, and they were all opposed to the proposed legislation.

Knowing as we do that merchandising of appliances by the public utilities is not only of vital importance to the utilities themselves, not only of benefit to their consumers, but actually of benefit to competitive merchants, we are now confronted with the question as to what is the best policy to be adopted with respect to the future. Shall we continue to merchandise along the lines that we have followed in the past and content ourselves with meeting the opposition in the halls of the Legislature or in the Courts, or shall we attempt to cooperate with the local merchants, and through meetings and conferences with the various retail trade organizations, attempt to arrive at a better understanding of our mutual problems, to the end that an amicable solution of the entire problem be reached?

You will no doubt be interested in the progress which we are now making in Los Angeles in working out the problem through a joint committee of merchants and utility representatives. A few months ago a friendly banker of Los Angeles invited a number of the leading merchants of the city, and the representatives of the various utilities, to attend a luncheon for the purpose of seeing whether, by mutual cooperation, our differences could be adjusted. At this meeting the merchants stated that their primary objection to utility merchandising was due to the excessive trade-in value given by utilities for old appliances; to the excessive extension of credit in payment for new appliances; to the elimination of interest on deferred installments, and to the granting of cash discounts. The utility representatives stated that they were willing to agree to any fair standard of business ethics, provided they were not required to retire from the merchandising field, explaining to the merchants the reasons why it is absolutely imperative for the utilities to merchandise appliances.

As a result of this meeting a committee was formed composed of representatives of the leading merchants of the city and representatives from the utilities, the chairman of the committee being one of the leading merchants of Los Angeles. Numerous meetings were held, as a result of which the utilities made a proposal that unwarranted elimination of interest on deferred payments would not be resorted to; cash discounts employed by some of the utilities would be discontinued, and all concerns would agree to allow a maximum of 10 per cent of the price of the new equipment as the trade-in value of the equipment being displaced. From this beginning, the proceedings rapidly culminated in an agreement satisfactory to all parties, the merchants as well as the utilities, and the final draft of the agreement is now in course of preparation.

In the course of the proceedings, relations were continually bettered, and a spirit of

fair-mindedness and open-mindedness became more and more apparent. At the last meeting of the group, represented by the chairman and several representatives of the merchants association, the chairman, with the concurrence of the other members of the merchandising groups, expressed his great pleasure at the spirit of fairness and frankness displayed by the utility representatives. He went so far as to say that whereas a few months ago he had been of the impression that utility merchandising was a distinct detriment to their business, he now felt that if the utilities were to discontinue merchandising, the merchant group should make it their business to petition the utilities to continue their merchandising activities, because he felt such continuance would be a distinct contributing factor to their own successful merchandising. The other merchant representatives present agreed with the chairman's expression of opinion; and it seems unquestionable that the foundation has been laid for the best relations which have ever existed between the two groups.

I am sure that the gas industry of California is willing to go more than half way in order to cooperate with the independent merchants and arrive at a high ethical standard for merchandising that is fair to all. I am equally confident that the utilities of this state should and will fight to the bitter end any attempt to legislate them out of business.

Peoples Gas Light & Coke Reports Gain in Net Profits

Net profits of Peoples Gas Light & Coke Co., Chicago, for the 12 months ended September 30, 1931, were reported at $7,007,888, after all charges, as compared with $6,887,685 for the corresponding period of last year.

Applying Gas Purchase Law in Texas

FOLLOWING the Texas legislature's recent passage of the "Amendment to the Common Purchaser Act," the Railroad Commission of the State of Texas held a special hearing on September 28 to determine the rules and regulations governing the purchase of natural gas which should be prescribed to carry out the policies underlying the new law.

At this meeting of the Commission, the following rules and regulations for the functioning of the law were set forth:

"Rule 1. Gas is to be purchased without discrimination.—Each common purchaser shall purchase ratably all natural gas which may be offered for sale and which may be reasonably reached by its trunk lines or gathering lines without discrimination in favor of one producer or person as against another in the same field and without unjust or unreasonable discrimination as between fields in this State. It is expressly provided that no common purchaser shall discriminate between like grades and pressures of gas or in favor of its own production or of production in which it may be directly or indirectly interested. . . .

"Rule 2. Gas is to be purchased ratably.—Whenever the legally withdrawable amount of gas from any common source of supply in this State is in excess of the market demands of the common purchasers of such gas or in excess of their facilities for taking and utilizing such gas, then any producer . . . may take therefrom and tender for purchase only such portion of the natural gas . . . as the natural flow of the well or wells owned or controlled by any such producer bears to the total natural flow of such common source of supply . . . the Railroad Commission of Texas may, by proper order, permit the taking of a greater amount whenever it shall deem such taking reasonable or equitable.

"Rule 3. Commission will issue special orders where necessary.

"Rule 4. Purchaser shall provide meter.

"Rule 5. Certificate to be secured by producer.—Producers shall . . . secure from the Railroad Commission of Texas a certificate showing compliance with the oil and gas conservation laws of the State and conservation orders of this commission. . . .

"Rule 6. Certificate to be furnished to purchaser.—Purchasers shall not accept deliveries from any gas wells until the owners or operators thereof shall furnish a certificate from the Railroad Commission of Texas showing the conservation laws of the State have been compiled with. . . . .

"Rule 7. Gas to be purchased shall be marketable gas.—. . . By the term 'marketable gas' is meant natural gas in its natural state" (also residue gas from gasoline extraction plants, and certain casinghead gas) "free from liquids, corrosive substances and other foreign matter and free from excessive air content. . . . .

"Rule 8. Gas involved in litigation, etc.—Indemnity against loss. When any gas tendered for purchase is involved in litigation or the ownership of which is in dispute or which may be encumbered by lien or charge of any kind, the purchaser may withhold payment therefor until such litigation or dispute is disposed of . . . or such purchaser may require an indemnity bond to protect it against loss.

"Rule 9. Purchaser of one kind of gas not required to take other kinds.—A purchaser of natural gas only shall not be required to take casinghead or residue gas, and likewise, a purchaser of casinghead gas only, or a purchaser of residue gas only, shall not be required to take any other kind of gas.

"Rule 10. Purchasers not required to use artificial means to take gas—Purchasers shall not be required to construct or utilize compressor stations or use other artificial means in order to take the gas tendered for purchase. . . . .

"Rule 11. Unit of measurement for gas.—For all purposes applicable herein the unit of measurement of gas deliverable hereunder shall be 1000 cubic feet of gas computed at a base pressure of 2 pounds above an assumed atmospheric pressure of 14.4 pounds, a standard base and flowing temperature of 60 degrees F., and a standard gravity of .6.

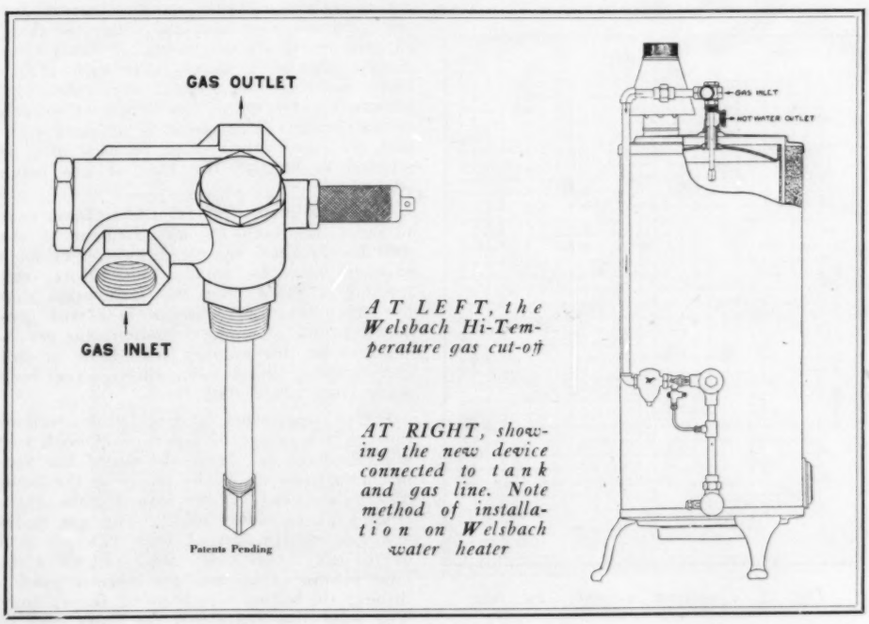
"Rule 12. Length of time connections to continue—After a well has once been connected to a purchaser's line the same shall remain connected and gas shall be delivered therefrom during the life of the lease upon which the well is located, except for temporary periods necessary for reworking or reconditioning the well and provided that after a period of —— years from the time the connection is made the producer shall be allowed to disconnect his well and make such other connection to such other common purchaser as he may desire, upon giving six months written notice to the purchaser, if at the time such notice is given there is being paid by the purchaser or by any other common purchaser a price for gas of like quality and pressure in the same field in excess of that then being paid to the producer desiring to disconnect his well. (Producers recommend one year, purchasers five years for term)."

New Welsbach Control Placed on Market

THE Welsbach Co., Gloucester City, N. J., announces a new temperature control called the Hi-Temperature gas cut-off.

Before water temperature can reach 212° F., the new device automatically shuts off the supply of gas to the heater when the water cools to normal operating temperature, the gas supply is reestablished by pressing a button. Should conditions causing high water temperature not be corrected, the Hi-Temperature gas cut-off will continue to shut off the heater's supply before hazardous temperatures are reached.

The new device can be installed on any boiler or water heater.



AT LEFT, the Welsbach Hi-Temperature gas cut-off

AT RIGHT, showing the new device connected to tank and gas line. Note method of installation on Welsbach water heater

Ignition Velocity for Air, Gas Mixtures

(Continued from Page 31)

a projector by removing the extension on the back and placing it on the lower portion of the table. A 250-watt lamp, placed in a 4-inch tee, was fitted with an upright 4-inch pipe for venting, and a horizontal pipe for concentrating all light on a condensing lens. The lens placed between the lamp and the image to be projected. To preclude distortion of the image, the projector and the surface of the projection screen must be level, and the reflecting mirror at an angle of 45 degrees. The screen is of plate glass frosted on the upper surface.

In the use of this equipment for determining the ignition velocity of any air-gas mixture the procedure involves five definite steps. They are:

1. Measuring and proportioning the air and gas in the mixture in order to determine the air to gas ratio.
2. Photographing the flame (inner cone).
3. Projecting the photograph of the flame on the ground glass screen.
4. Measuring the dimensions and area of the projection and calculating the inner cone surface.

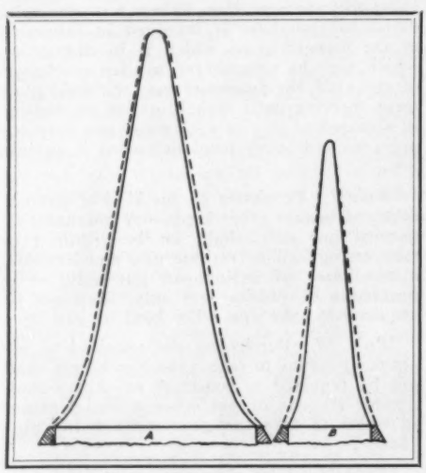


Fig. 4. Effect of air-gas ratio and chemical composition on shape of inner cone.

5. Calculating the ignition velocity from the above data.

The first step in the procedure is outlined as follows and will be made clear by reference to Fig. 2: After the prover is filled with the gas or mixture of gases to be tested, the valves to the right of the prover and the inlet and outlet (4) valves to the meter are opened. The regulator (12) is adjusted to give the desired flow of gas through the gas orifice meter into the mixing tube (22) and through the burner (23). The next step is to open the valve in the air line until bubbling occurs in the air regulator (6), which is an open end pipe immersed in a container of water. The inlet and outlet valves to the air meter are then opened and the regulator (11) adjusted to give a flow of air through the air orifice meter (19) into the mixing tube (22)) where the mixing of air and gas takes place.

The by-passes (3 and 7) were originally placed in the assembly so that, after the orifice meters were calibrated against the wet meters it would not be necessary to use them, as they might cause fluctuations in the flow. However, with the diaphragm regulators and the orifices both on the outlet side of the meters, fluctuations in pressure were not noticeable.

The procedure in obtaining the gas and air rates is to set the regulators to give a soft flame at the start and then increase the air by steps until either flash-back or blowing occurs. This is done by keeping the differential pressure across the gas orifice constant and increasing the differential pressure across the air orifice slightly for each exposure. As the air rate or air-gas ratio is increased, the total volume increases, but the ignition velocity of the gas increases much faster than the volume, making the flame harder and shorter until flash-back may occur. This tendency may be offset by increasing the quantity of both air and gas. After the maximum ignition velocity is reached, the inner cone becomes longer and the outer one begins to disappear, as the rate of air flow is increased. A continued increase in the air rate will eventually cause the flame to blow from the burner port. Blowing may be prevented by reducing the quantity of both air and gas.

For each air-gas ratio setting, the air and gas rates are obtained by timing the wet test meters. The orifice meters and differential gauges are used as indicators to show that a constant rate of flow is being maintained, and for obtaining uniform changes in either gas or air rates.

It is essential that the temperature of the various air-gas mixtures be the same. Research work in Germany indicates that the ignition velocity varies approximately as the square of the absolute temperature of the mixture prior to combustion. In the work done at the Laboratory, the mixture temperature was held at 70°F. plus or minus 2°.

The second step in the procedure consists of photographing the flames. Photographs are taken on 5x7 inch plates with seven to eight exposures of flames and one of a scale (to determine magnification) on each plate.

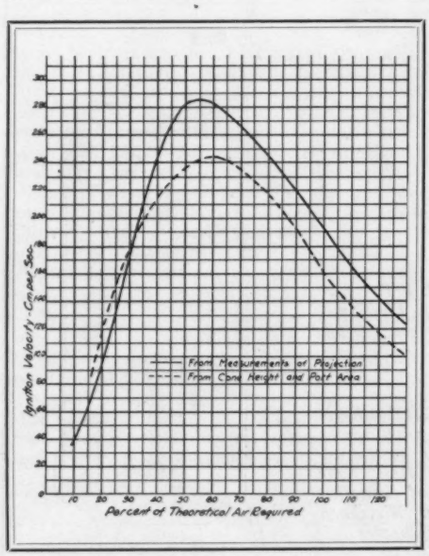

Ignition Velocity Centimeters per Sec.
From Measurements of Projection
From Cone Height and Port Area
Percent of Theoretical Air Required

Fig. 5. Ignition velocity by two methods.

Before making an exposure ample time is allowed after each setting of the differential gauges for the mixing tube to become thoroughly purged.

Since different gases produced flames of different colors, it was necessary to select plates with emulsions sensitive to the color produced by each gas. The emulsions required were available in commercial plates, as follows: (1) Eastman "Speedway," which is sensitive to all colors except green, yellow and red, (2) Eastman "Orthochromatic," being sensitive to all colors except red, and (3) Wratten "Panchromatic," which is sensitive to all colors. A few examples will illustrate the reasons for using various emulsions, depending on the particular color of the flame. The inner cone of the hydrogen flame, for instance, which is blue only, but quite luminous at low air gas ratios due to dust particles in the air, will photograph on Orthochromatic or Panchromatic plates, but the luminous dust particles obscure the inner cone. It was found that the best results on hydrogen were obtained with Speedway plates, which are sensitive to blue and purple. Ethylene and the fuel gases producing a green inner cone photograph very well on Orthochromatic plates.

The length of time required for an exposure varies with the color of the flame. Flames with a well defined inner green cone, such as ethylene and carbureted water gas, require an exposure of only two to four seconds. Natural gas and coke oven gas flames in which the color of the inner cone is less intense, require four to 10 seconds exposure. The flame produced by hydrogen, which is almost invisible at high air-gas ratios, requires a four to 30-minute exposure on the Speedway plate.

After the photographic plates have been developed and dried, they are placed in a special attachment on the back of the camera and used as shown in the projector assembly in Fig. 3. They are then projected as an ordinary lantern slide on a mirror, which is set back a distance to give an image magnified approximately 10 times on the frosted glass surface of the table top. This image is outlined in pencil and then measured.

It has been stated that burners of three diameters were used. Since some question might exist as to the possible effect on the results secured when using burners of different diameters, ignition velocity curves for several gases were obtained using the three burners previously described. A direct comparison showed definitely that such differences as could be noted were obviously accountable for within the limits of experimental error. This point is of interest in that the size of burner to be used may be selected to best fit the type of gas being studied.

The usual method of calculating inner cone surfaces has been by measurement of the cone height either by a cathetometer or from photographs. As pointed out before, this method is based upon the assumption that the inner cone of the flame is a true geometric cone. In order to compare the results obtained in this manner with those of this investigation, some calculations have been made from actual data.

Fig. 4 represents vertical cross sections through the center of inner cones with two different burners. In A, the dotted line represents a drawing of the image of the inner cone as projected on the frosted glass screen from a photographic plate. The gas under test was ethylene mixed with 59.6 per cent of the air theoretically required, while the total volume of air and gas mixture passing through the burner was 10.00 cu. ft. per hour. The solid line represents the inner cone of

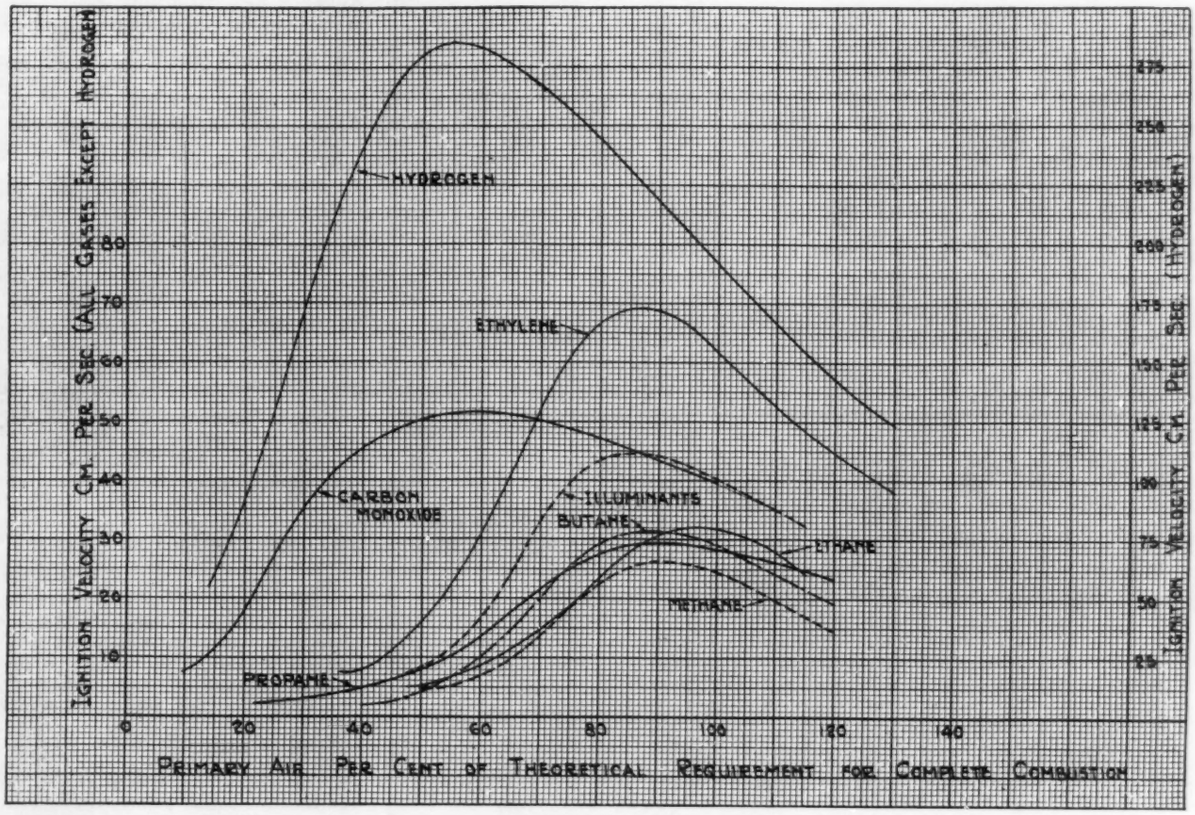


Fig. 6. Ignition velocity of various simple gases.

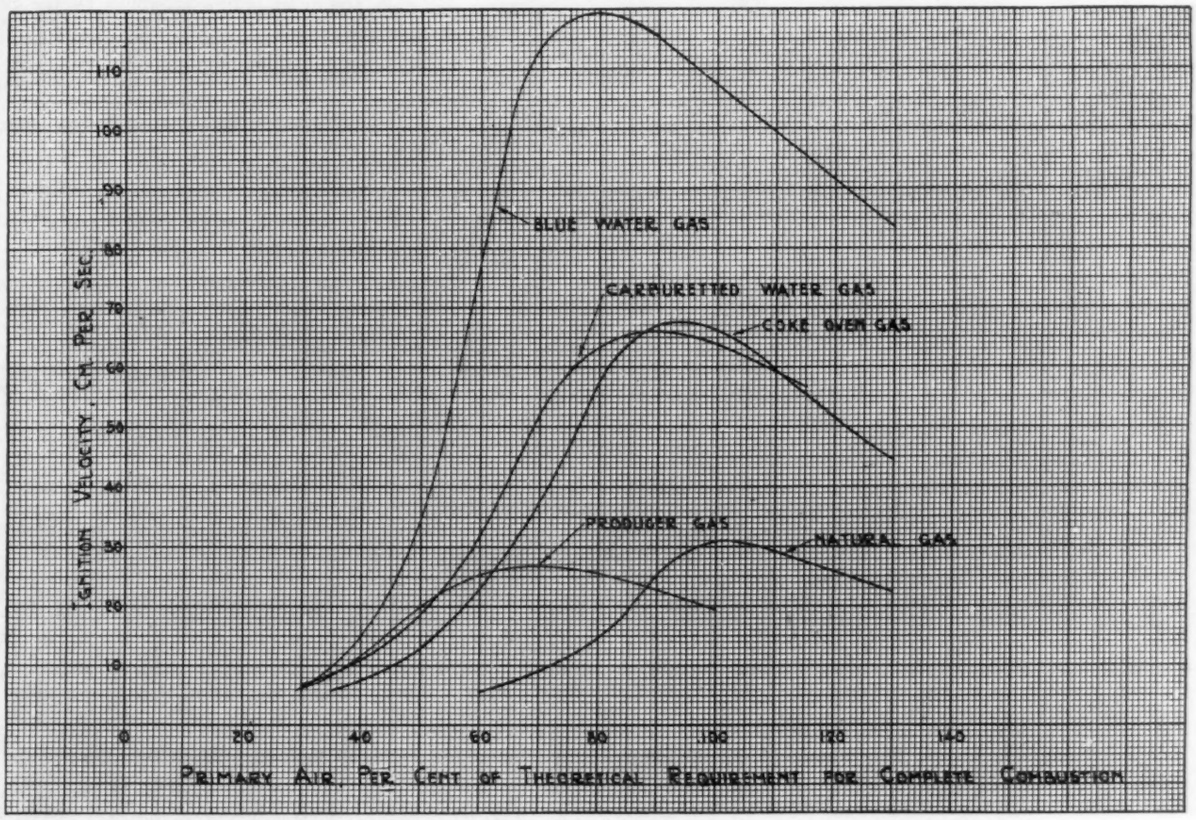

Ignition Velocity, Cm. Per Sec.
BLUE WATER GAS
CARBURETTED WATER GAS
COKE OVEN GAS
PRODUCER GAS
NATURAL GAS
Primary Air Per Cent of Theoretical Requirement for Complete Combustion

Fig. 7. Ignition velocity of common gases.

TABLE NO. 1. DATA ON GASES SHOWN IN FIG. 6
(Gas and Air Saturated with Water)

Gas	Heating Value B.t.u. per cu. ft.	Specific Gravity (Air = 1.0)	Theoretical Air Required Cu. ft. per cu. ft. of gas
Hydrogen	325	0.0695	2.39
Carbon Monoxide	323	0.9672	2.39
Ethylene	1639	0.9748	14.35
Ill. { 25% C_6H_6 / 75% C_2H_4 }	2153	1.404	19.7
Methane*	1049	0.592	9.77
Ethane**	1713	1.04	16.05
Propane	2586	1.563	23.88
Butane***	3170	1.95	30.7

* Analysis of gas used; 90.8% CH_4, 5.8% C_2H_6, 0.5% Ill., and 2.9 inerts.
** Analysis of gas used: 90%C_2H_6 and 10% hydrocarbons including CH_4, C_3H_8, C_3H_6, and C_2H_4.
*** Analysis of gas used; 71.0% Nor–C_4H_{10}, and 24.8% Iso–C_4H_{10} and 4.2% C_3H_8.

TABLE NO. 2. DATA ON GASES SHOWN IN FIG. 7
(Gas and Air Saturated with Water)

	Producer Gas	Blue Gas	Carburetted Water Gas	Coke Oven Gas	Natural Gas
Heating Value, B.t.u. per Cu. ft.	143	282	560	525	1123
Specific Gravity, (Air = 1.0)	0.908	0.607	0.640	0.377	0.693
Analysis, Per cent CO_2	0.7	5.0	2.6	2.3	0.1
Ill.	0.2		10.1	3.5	0.0
O_2	0.4	0.7	0.9	0.4	0.3
H_2	6.9	47.5	35.4	57.4	
CO	34.2	38.2	30.8	7.2	
CH_4	0.5	0.3	11.0	23.1	71.1
C_2H_6			0.9	0.4	22.3
N_2	57.1	8.3	8.3	5.7	6.2
Total	100.0	100.0	100.0	100.0	100.0
Air Required/ cu. ft. of Gas	1.05	2.04	4.72	4.49	10.03

a flame using the same gas and burner and having exactly the same cone height but with 100.2 per cent theoretical air and 18.46 cu. ft. of air gas mixture passing through the burner per hour. Here the cone height, gas, and burner size were the same but the air-gas ratio and total volume of gas flowing through the port varied. With a high air-gas ratio, or hard flame, the base of the cone had the same diameter as the port. With a low air-gas ratio, or soft flame, the diameter of the base of the cone was greater than the diameter of the port.

In B, of Fig. 4, the small burner was used. The solid line represents the inner cone of a hydrogen flame with 68.4 per cent of the theoretical air and a total volume of air and gas mixture flowing through the port of 26.3 cu. ft. per hour. The broken line represents the inner cone of a carbureted water gas flame with 86.5 per cent of the theoretical air required and a total volume of air gas mixture flowing through the port of 6.31 cu. ft. per hour. In this case two different gases having the same cone height were used with the same size burner, but with their areas of combustion unequal. The base of the inner cone of the carbureted water gas flame was larger than the burner port, while the base of the inner cone of the hydrogen flame was the same size as the burner port. This shows that the method used by Ubbelohde and de Castro (Thesis, Karlsruhe, 1905) was in error, as the ratio between cone height and surface of combustion for various air gas mixtures and different gases is not constant. Fig. 5 shows the ignition velocity of hydrogen obtained by different methods of measuring the inner cone. The ignition velocity shown by solid lines was obtained by the method of measurement used by the A.G.A. Laboratory. The broken line shows the results obtained when calculated from the cone height and port size.

Ignition velocity curves, secured by the method outlined, of several common gases and a number of simple gases including the principal constituents of city gases are shown in Figs. 6 and 7. Essential data affecting the several gases are shown in Tables No. 1 and No. 2. It will be noted that ignition velocity is plotted against percentage of theoretical air required. This practice is followed for two reasons: (1) The adjustment of burners is usually made to give a certain type of flame, obtained by premixing a rather definite proportion of the total air requirement as primary air; and (2) where the gases vary widely in total air requirement, a representation of the results by percentages of gas in the mixture would obviously offer no basis of comparison.

It can be seen that for the same percentage of primary air, or same type of flame, a considerable range of ignition velocities is embraced by the gases shown. A notable characteristic is that the maximum ignition velocity generally is not found at 100 per cent primary air but varies depending on the gas.

The ignition velocity curves shown in Figs. 6 and 7 are but a few of the many similar curves established during the course of the Mixed Gas Research Investigation. About 115 ignition velocity curves on various gases and mixtures of gases have been determined. These have been particularly useful in the study of many gas mixing problems.

The determination of ignition velocity of air-gas mixtures as described involves the dynamic method of employing the actual area and height of the inner cone of a Bunsen flame. This procedure most nearly represents the actual conditions prevailing in the utilization of gas. A thorough study of the method shows it to be simple and fairly rapid in application. The method, furthermore, is accurate and yields results which are easily reproduced well within the limits of experimental error.

Reliance Regulator and American Meter Interests Combine

ANNOUNCEMENT has been made of the acquisition by American Meter Co. of the Reliance Manufacturing Co., and the Reliance Iron Works of Alhambra, Calif. A new company is being formed under the name of Reliance Regulator Corp. to conduct these properties. The management of the former Reliance interests will be retained intact and no changes in the present personnel of the Regulator Division are being contemplated.

W. M. Thompson

Officers of the Reliance Regulator Corp. are W. M. Thompson, president, W. D. Dickey, manager Pacific Meter Co., vice-president; C. T. Bixler, secretary and treasurer. Directors are A. C. Thompson, John Gribbel, president, American Meter Co.; F. H. Payne, manager, Metric Metal Works; Donald McDonald, manager, American Meter Co. at New York. Additional members will represent the new interests. J. J. Delaney will continue as general sales manager while W. I. Thrall will act in the capacity of general manager.

Preparation is now under way to manufacture the complete Reliance line at Erie, Pa., to supply the eastern trade, and convenient distribution points will be established to handle Mid-Continent and eastern trade.

American Meter Co. manufactures a complete line of displacement meters, orifice meters, rate volume controllers, as well as gas and meter testing apparatus for the gas and oil industries. The company is now in a position, through the Reliance Regulator Corp. to add to its specialization in gas measurement the problems relating to gas regulation, which, with the growth in semi-high pressure distribution, have become more and more closely related.

J. A. McCutchin Gets Natural Gas Department Fellowship

John A. McCutchin, affiliated with the Oklahoma Geological Survey, has been named by the American Gas Association Committee on Supply Men's Fund, of the Natural Gas Department, as recipient for the natural gas fellowship at the University of Oklahoma.

Mr. McCutchin is a graduate of the University, class of 1928, with a B.S. degree in geological engineering.

1,000,000 c.f. Well in New Colorado District; May Serve Towns

Mid-Colorado Petroleum Corp. reports bringing in a 1,000,000 cubic foot well in the Park district, Routt county, Colo., the well proving the territory for gas. It is reported that the company plans to serve Steamboat Springs and the adjoining towns with gas.

Service at Meeteetse, Wyoming

Gas service began in Meeteetse, Wyo., on October 1 through a line of the Rocky Mountain Gas Co., headquartered at Casper. The supply comes from fields near the town.

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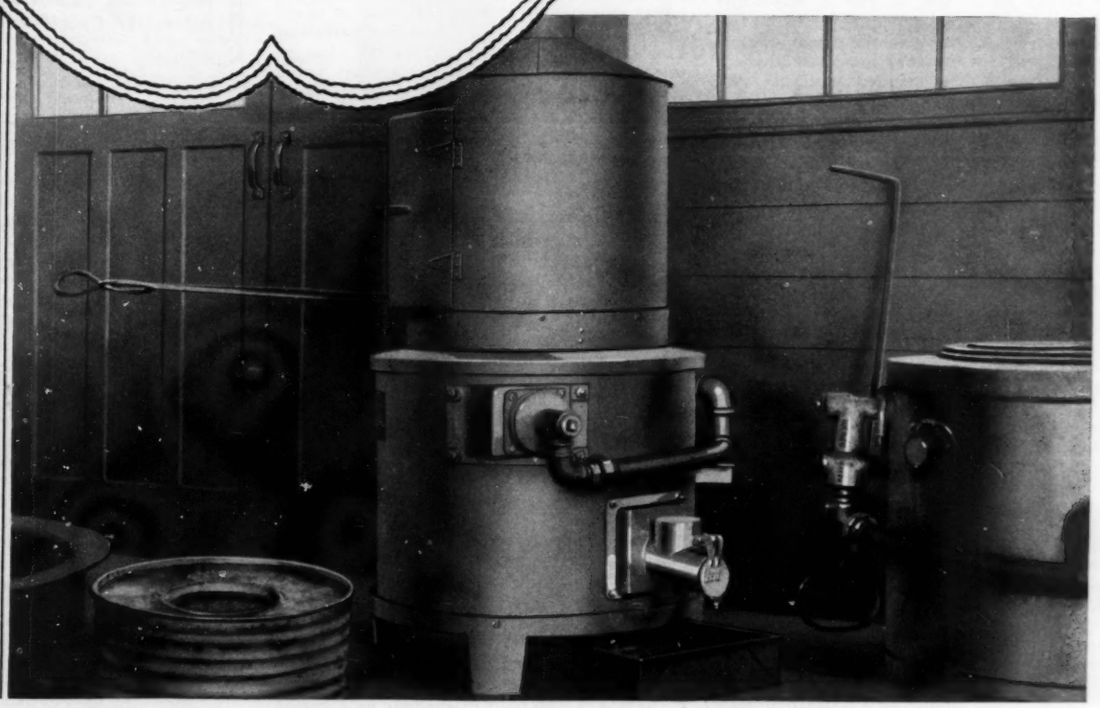
BUILT TO DELIVER DEFINITE OPERATING RESULTS

LOW fuel consumption—accurate furnace atmosphere control—absolute heating dependability—definite operating and production results. These features are what your industrial prospects are seeking in heat treating equipment. SC Rated Furnaces have these features—and more! The cyanide pot hardening unit below is installed in the Rollaway Bearing Co. plant at Syracuse, New York. It is used for hardening roller bearing stock—an exacting process. It is only one of several Rated furnaces of various types purchased by Rollaway—all giving more than satisfactory results. Other SC Rated Furnaces are also furnished as follows: small oven, forging, rivet heating, and oil tempering.



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BUTANE - PROPANE NEWS
Covering Liquefied Petroleum Gas Service

Future Supply . . . from Refinery or Natural Gasoline Plant?

By B. F. SPIGENER
Columbian Gasoline Corporation

THE economics of future liquefied petroleum gas supply are intimately bound up with the problems of the petroleum refiner and the natural gasoline plant operator. As the author of this discussion sees it, these two closely related industries must work together if their interests, and those of the growing liquefied gas industry, are to be best served—the refiner providing a market for highly stable natural gasoline, and absorbing refinery butane-propane products in finished motor fuel; this making a continually greater percentage of liquefied gas products available from the natural gasoline industry.

Since price structures in the liquefied petroleum gas markets will react directly to developments in the refining and natural gasoline manufacturing field, users of these products will read this discussion with much interest. Mr. Spigener's remarks were prepared for the last quarterly foreman's meeting of the Columbian Gasoline Corp.

—EDITOR

THE refiner is learning to dispose of the excess butane which he has in his plant. In times like the present, when fuel is cheap, and butane has a value of little more than ½c per gallon for refinery fuel, it would appear that the refiner would so balance his operation as to permit him to purchase such natural gasoline on the outside as would enable him to utilize greater volumes of his otherwise wasted butane. He can do this by buying partially de-butanized natural gasoline, blending it with his own butane, and thereby receiving for that butane the same price as he receives for his regular refinery gasoline.

In most cases the saving in freight on the 25 to 35 per cent butane in regular AA gasoline would allow him to pay a reasonable premium to the natural gasoline manufacturers for the partially de-butanized natural gasoline, and yet lay that material down at such a price which, blended with his own butane, would show him a profit.

I believe that a good deal of money can be made by the refiner who will purchase his natural gasoline requirements by the new specifications recently announced by the Natural Gasoline Association.

There are many problems common to both branches of the oil industry. The refiner is advanced in the cracking field, which the gasoline manufacturer is just approaching in his researches for a proper outlet for excess butane.

On the other hand, the natural gasoline manufacturer is in the vanguard in problems of rectification. Both are interested in the product of natural gasoline manufacture. The refiner should absorb natural gasoline into his own fuel wherever possible and avoid its deviation into a product which would place it in a price competition with motor fuel itself, with continuing disastrous results.

As has been said, the integrated company which produces natural gasoline can help stabilize the situation and bring the production in line with demand.

It would appear to be only primmer philosophy that the refiner will eventually pay no more for butane than the cost necessary to extract it from his refinery gases.

This, of course, is the total cost including the value of the butane as a finished product for other purposes or its value as a raw material for other processes.

Economics Favor Supply from Natural Gasoline Industry

It does not appear that the refiner would not continue to purchase butane in the form of natural gasoline and sell it in competition with liquefied petroleum gas at a price below cost. Eventually the law of supply and demand will take care of any unsound practices. The economic pressure will tend to favor the situation in which butane will be first available from the natural gasoline industry rather than from the refinery, since it will become a waste product at the natural gasoline plants before it does at refineries, as it will have little or no value as a raw material in its present chemical form.

After extracting sufficient butane for his own motor fuel requirements, the excess product then will become a waste product of lower value to the refiner and must of necessity seek an outlet in the liquefied petroleum gas market or will be chemically changed into other products of higher market value.

The continual increase in use of oil cracking processes by the refiner will compel the natural gasoline manufacturer to sell still more stable grades of natural gasoline, which in turn will increase the supply of liquefied petroleum gases available from the natural gasoline industry.

The average motor fuel contains 0.3 per cent propane and 4.7 per cent of butane. The average daily consumption of motor fuel amounted to approximately 45 million gallons in 1930. This means that the motoring public last year daily consumed about 2¼ million gallons of liquefied petroleum gases in its motor fuel. Statistics indicate that as a very conservative estimate there is a daily potential production of at least 13 million gallons of liquefied petroleum gases from the natural gasoline industry.

Butane, which is a gas at atmospheric pressure and at temperatures higher than 26° F., finds its market in the manufactured gas industry and in various other industries. This product is used as an enricher to increase the calorific value of certain gases as a means for meeting peak load situations, and as the sole base material for the manufacture of gas for small towns where the installation of the conventional type of gas plant would not be economically feasible.

Butane is also used extensively as a gaseous fuel in many and varied industrial heating operations. The superiority of this high grade gaseous fuel is most fully realized where the consumption is large and where an economical, clean and easily controlled fuel is advantageous. In addition, high efficiency of combustion is made possible by the uniformity and purity of the product. It is for this reason that the industrial use of butane has been receiving such rapid recognition. When used as an industrial gas it is of course in direct competition to the product of the manufactured gas industry. In some instances prices equal to that of natural gasoline or lower have been offered.

The number of small town butane gas plants supplied with fuel by Philfuels Co. and using butane as the sole base material for gas manufacture increased from 1 at the end of the year 1928, to 7 at end of 1929, to 40 served with fuel in 1930. During 1930, several other companies became interested in butane-air process plants, the Standard Oil Co. of California and the Skelly Oil Co., being especially active. It is estimated that 50 or more plants are now being constructed or are under contract for construction.

It is estimated that the total number of purchasers of all forms of liquefied petroleum gases in tank car quantities increased from 60 at the end of 1929 to 90 at the end of 1930. It is known definitely that the products have been purchased in wholesale tank car quanitities in at least 34 states and Canada, representing 105 points to which the commodities were shipped, most of which were shipped into territory lying east of the Mississippi River.

Undiluted Propane Service for Belvedere, N. J.

The Suburban Gas Co. of Belvedere, New Jersey, is now constructing a propane distribution system to serve that city. The company formerly served the city with "bottled" gas. The distribution system will be served from an undiluted propane plant which also served the bottled gas users. The system is designed to serve approximately 400 users.

National Bottled Gas Industry Organizes

AN ORGANIZATION known as "The National Bottled Gas Association" was formed at the recent American Gas Association meeting, held at Atlantic City. The organization is primarily made up of producers and distributors, although dealers, equipment manufacturers and appliance manufacturers will be associated with it.

Mark Anton
President
National Bottled Gas Assn.

Actual plans are now being worked out by the board of directors for the basis of membership, the establishment of by-laws, etc., and several committee meetings have been held since the middle of October to put the new Association machinery in working order.

The purpose of the organiaztion is to foster the growth of the business along logical and ethical lines; to eliminate unethical advertising and unethical practices; develop better sales methods; standardize on equipment and appliances.

Mark Anton, Suburban Gas Co., Belleville, New Jersey, has been elected president; Don Kelly of Universal Bottled Gas Co., Rochester, N. Y., vice-president; Plumer E. Pope, Fuelite and Natural Gas Corp., Waltham, Mass., vice-president; Richard Ely, Island Home Commodities, Hicksville, Long Island, secretary; John G. Rose, Jack Rose Supply Co., Pittsfield, Mass., treasurer.

The board of directors of the organization, in addition to the above officers, includes William H. Frank, Jr., distributor of Pyrofax, Poughkeepsie, N. Y.; Howard S. Bunn, Carbide and Carbon Chemical Corp., New York; Charles G. Norse, Suburban Gas Co., Providence, R. I.; H. E. Double, Bradford Gasoline Co., Bradford, Pa.; H. Emerson Thomas, eastern representative, Philfuels Co., New York.

About 75 per cent of the eastern distributors, active in bottled gas distribution, were present at the meeting.

The organization plans to meet quarterly or more often. Early in January, a meeting is planned to be held in New York, at which a permanent organization set-up will be effected.

A. C. Fickes Now With The Biggs Boiler Works Co.

Alfred C. Fickes, for the past 8 years general sales manager of the Lancaster Iron Works, Lancaster, Pa., recently became associated with The Biggs Boiler Works Co., of Akron, Ohio, as sales manager.

Mr. Fickes has been identified with the steel industry for many years, as a mechanical and structural engineer with the Philadelphia and Reading Coal and Iron Co., Lehigh Coal and Navigation Co., Southern Pipe Line Co., Bethlehem Steel Co., and McClintic-Marshall Construction Co., before entering the service of the Lancaster Iron Works in 1915 as chief engineer.

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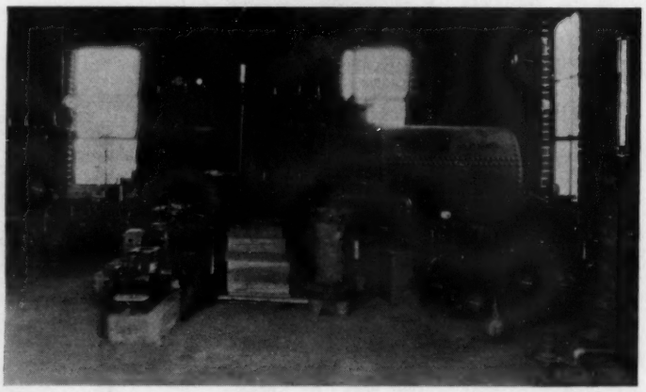
AT LEFT:

The plant is of stone construction, 24 feet square, and divided into a main room for carbureting equipment, a room for water heater and hot water tank, and an office.



AT RIGHT:

Interior of Lakeview Gas Co. butane-air plant at Lakeview, Oregon, showing arrangement of apparatus in main operating room.

...Dependable PACIFIC PIPE

105 feet of McWane-Pacific Cast Iron gas pipe going in in one section, to give dependable service.

NO COATING NEEDED — it's cast iron pipe.

NO DEPRECIATION—it can't rust—it's cast iron.

And it's western-made, for all ordinary sizes and pressures of gas mains, "with a joint for every pressure." Address:

McWANE CAST IRON PIPE CO. BIRMINGHAM ALABAMA

PACIFIC STATES CAST IRON PIPE CO. PROVO, UTAH

SAN FRANCISCO 111 Sutter St.

LOS ANGELES 417 S. Hill St.

DALLAS—1807 S. F. Bldg.

DENVER 226 Cont. Oil Bldg.

KANSAS CITY 1006 Grand Ave.

Design of Butane-Air Gas Plant at Lakeview, Oregon

ONE of the recent developments in the butane gas field is that of the Lakeview Gas Co. at Lakeview, Oregon, consisting of a low pressure distributing system and a cold carbureting plant using the Parsons "Kemp" carburetor system.

Lakeview is situated in Lake County, Oregon, on the line of the new highway now being constructed between San Francisco, Calif., and Yellowstone Park. The town is compactly built on a gently sloping area facing Goose Lake and has a population of about 1800. A careful survey of the town and an analysis of costs convinced B. H. Steffen that the possibility of a favorable return on investment and effort was quite justified when utilizing butane.

The plant has been in successful operation since the first of March, with 67 meters being connected up to July 1. Additions are being made as rapidly as possible with the small force employed, and present indications are that not less than 170 customers will be receiving gas from this plant by January 1, 1932—a very commendable showing for a 10-month period.

At the outset, it appeared necessary to keep total investment at the lowest point consistent with satisfactory service. It was also considered essential to keep overhead and management costs at a low figure, it being manifest that if either or both of these costs were excessive it must be repaid in rates, and if the rates were high the venture would prove a failure.

Due in large measure to the lay-out of the town, a low pressure system of distribution was adopted. The town proper is very compact. The gas plant is located on the outskirts alongside a railroad spur in order to facilitate delivery of butane. The distance from the gas plant to the center of town is not over one-half mile.

Instead of putting in a compressor with a carbureting valve for a high pressure storage system, a complete "Kemp" gas machine consisting of a semi-contact positive low pressure blower affording a maximum pressure of 2 pounds, together with the carbureting valve, was installed. This unit is operated at about 2 pounds pressure, the gas passing thence into the improvised gas storage tank, thence through a reducing regulator to line pressure which is maintained at about 8 inches water column. Two old tubular boilers that might be adapted to gas storage were available and the tubes were taken out, the shells riveted together, end to end, and sizeable gas storage thus provided.

The gas machine is driven by an electric motor and as electric service is subject to interruptions due to storms, burn outs, etc., it has been found expedient to put in a small gas engine as an auxiliary driving unit. Present indications are that this gas engine may be used most of the time rather than the electric power, on account of reducing cost of operation.

A 4-inch main was laid from this gas plant up to and through the town to its

upper limits, this main passing through the center of town and dividing it into two practically balanced halves.

From this main extending in both directions are 2-inch laterals on each of the intersecting streets, these laterals being tied together at the end, thus forming a double loop system which will afford good pressure conditions. All pipes up to the point of service are welded. Services are made with screwed pipe, mostly ¾-inch and 1-inch, and low pressure meters are used, these being supplied by the Pacific Meter Works and the Sprague Meter Co.

The Plant Building

The gas station proper consists of a stone building approximately 24 feet square, divided into three rooms, one main room for the carbureting equipment, this room also being used for assembling domestic appliances, such as stoves, ranges, water heaters, space heaters, etc.; a small room in one corner sealed off from the rest of the building for installation of water heater and hot water tank; the other small room being used for an office. The accompanying illustration indicates a very attractive building of a type that might very readily be placed in the center of a residence district without in any way detracting from the appearance of the district.

Butane is stored in a tank at the right of the building shown in the illustration. This tank is 8 by 10 feet in dimensions, of approximately 15,000 gallons capacity, built especially for butane storage and conforming to A.S.M.E. code standards.

Installation of a compressor to permit raising gas storage pressure to 40 to 50 pounds is to be undertaken when the demand reaches a point that cannot be safely taken care of by the low pressure storage. Under present conditions this low pressure storage will carry over for an hour or two, which appears sufficient, as there has been no shortage of gas in the line since the plant was started, notwithstanding the fact that several interruptions to electric power, including one burnout of station transformers due to lightning, have occurred.

All of the apparatus installed in this plant is of the simplest design and most rugged construction obtainable; all standard; and there being no special or complicated devices used, any mechanic can repair or readjust any part of the equipment with the simplest of tools. The carbureting machine has a capacity of 3000 cubic feet per hour at 2 pounds pressure. It is driven by a 1½-h.p. 3-phase motor, with a 3-h.p. stand-by gas engine.

While the latent heat of vaporization of butane amounts to 830 B.t.u. per gallon, and it may be presumed that a continuous expenditure of gas for generating this heat would be necessary, the gas-fired heater is used only about one hour per day, the stored heat being sufficient to continue vaporization during the balance of the day. While this will change as the demand increases it is thought that only during the coldest winter weather will continuous operation of the heater (in this case a small side-arm type) be necessary.

The butane is stored at a normal pressure of 20 to 40 pounds, educted from the bottom of the tank up through the top as a liquid; is passed through a heat exchanger at about 5 pounds pressure, heat being provided by a circulating hot water system thermostatically controlled, thence through a vapor meter, then reducing to practically atmospheric pressure at which point it is combined with inflowing air, through the carbureting machine. The air is taken directly out of the room, thus tending at all times

BROKAW, DIXON, GARNER & McKEE

Announce the Formation of

BROKAW, DIXON, GARNER & McKEE ENGINEERING CO., INC.

120 Broadway

New York City, N. Y.

for the purpose of engaging in the investigation, design, installation, construction and management of liquefied gas plants and distribution systems.

The management of this company will be under Mr. H. N. Witt, formerly Vice-President of Thebo, Starr and Anderton, Inc., of San Francisco, who have been identified, since its inception, with the successful development of the liquefied gas business on the Pacific Coast.

Brokaw, Dixon, Garner & McKee Engineering Co., Inc., has the exclusive rights for the installation of Thebo, Starr and Anderton, Inc., plants in the east.

GROBLE REGULATORS & GOVERNORS

Complete Line of Regulators for

Natural, Manufactured, Butane and Propane Gas

Pacific Coast Representative,

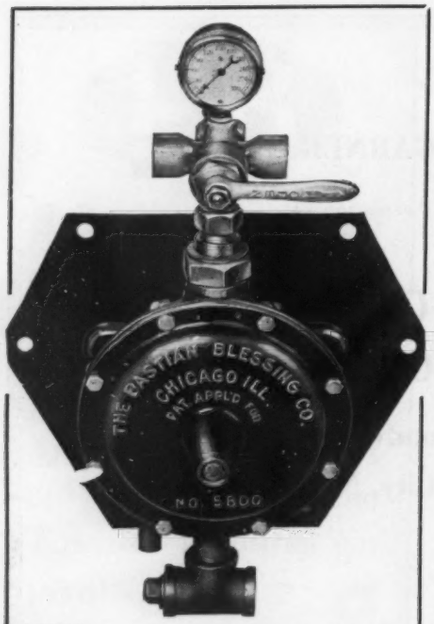
T. G. ARROWSMITH COMPANY,

661 Howard Street San Francisco, Calif.

Phone Garfield 8419

GROBLE GAS REGULATOR COMPANY

Office and Factory: Anderson, Indiana



The *Original* Petroleum Gas Regulator

When the Liquefied Petroleum Gas industry was yet a pup, The Bastian-Blessing Company, sensing its possibilities, designed, engineered, fabricated and installed the original control equipment. Today's wide acceptance of these units proves that planned products have a definite place.

The Special Pressure Regulator illustrated is merely a refinement of the original, which we created for the then-beginning industry.

The Rego Pressure Regulator is fool-proof . . . it is easily and quickly installed . . . has a diaphragm and seat immune to gas-attacks . . . and controls pressures perfectly. Models available for "wet" or "dry" gas.

Separate Units—or a Complete Assembly of Manifold, Regulator, Seal, etc.

Factory-tested assemblies, packed in substantial re-shipping cartons, solve the problem of installing controls "out on the job." These assemblies comprise Manifold, all Cylinder Connections, Two-way throw-over valve, Regulator, Mercury Seal and a supply of mercury.

Vast data on merchandising and distribution available. Ask us any question.

The Bastian-Blessing Company
254 E. Ontario St.
Chicago, Ill.

to ventilate the room. From the carburetor it passes to the low pressure storage tank at approximately 2 pounds, thence through the reducing regulator to line pressure.

Thermometers and gauges are so placed as to indicate temperature and pressure on the liquid butane, the butane vapor, and the finished gas. A Caloroptic calorimeter is used for determining heat value of the gas as passed to the system.

Adjustment of the carburetor for fixing the heat value of the finished gas is accomplished by means of a micrometer screw on the carburetor valve. A slight adjustment of this screw gives an instantaneous answer in change of B.t.u. value of the gas and there has been no evidence of variation of consequence in heat value since the plant was started, checks with the calorimeter being made at frequent intervals.

Climatic conditions in Lakeview are very similar to those in Calais, Maine, where a plant of this type has been in operation nearly two years, ranging from about 30 degrees below to 100 above zero. Frost does not, however, extend so deeply in the ground in Lakeview as at Calais, the maximum being about 6 to 8 inches depth. Another difference is that as a rule the cold snaps in Lakeview do not last so long as those in Maine. It has therefore been deemed unnecessary to provide any means of heating the butane storage tank. There is ample heating surface in the heat exchanger used in this plant, to take care of the lowest temperature mentioned, provided the tank pressure does not fall to zero and thus cut off the supply of liquid butane, a condition which is not expected. If, however, this condition does arise the butane liquid storage can easily be repressured sufficiently to permit operation, from the low pressure gas storage.

Auxiliary Storage

There is also an auxiliary butane storage tank, of 600-gallon capacity, equipped with hot water coils, which can be used if necessary during winter months, though the cold snaps experienced in Lakeview are of such short duration and so infrequent that this may not be used at all. Butane is not stored in this tank, it being intended only for temporary use during extreme low temperature periods, butane to be run into it only at such times.

Up to the first of July there were 67 meters connected. Rates are as follows: Domestic: First 200 cu. ft. or less, $1.00 (this is in the nature of a service charge); next 800 cu. ft., 25c per C or at the rate of $2.50 per M; next 2000 cu. ft., 20c per C or $2.00 per M; all over this amount 15c per C or $1.50 per M. This rate covers stoves and gas plates. Water heaters: First 200 cu. ft., $1.00; next 1800, 20c; all over this 15c. Commercial rate: First 1000 cu. ft., $2.50; next 4000 cu. ft., $1.50; all over this $1.25 per M.

The total cost of plant and distributing system was $18,000. The estimated number of potential consumers is 350, of which 170 will be signed up by the first of the year.

Butane Plants for Flora and Mt. Vernon, Ind., Reported

Great Northern Utilities, Inc., of Chicago, Ill., of which Arthur J. Smith is president, is planning construction of a plant and distribution system for the service of butane gas in Mt. Vernon, Ind. The company is also considering the establishment of a similar system at Flora, Ill.

There probably will be about 10 to 12 miles of high pressure mains installed in each of these towns, using 4-, 3- and 2-inch pipe, the distribution lines running through alleys, and under all pavements. A gas engine will be used to drive the compressors, and a Cutler-Hammer control will be employed. The same Bryant boiler used to heat the building will also furnish hot water to the vaporizer.

Fuel will be purchased from the Philfuels Co., and the distributing company will serve 530-550 B.t.u. gas.

At Flora, the company plans to have a 5-foot water gas set as a reserve with a 150-H.P. boiler.

The company plans to carry on merchandising activity in the territory, with booths set up in the central office for appliance display. Cooperation with dealers of the district is also planned.

Central Arizona Light & Power Co. Gets Franchise at Glendale

Central Arizona Light & Power Co. of Phoenix, Ariz., has been granted a franchise for the service of gas in Glendale, about 10 miles northeast of Phoenix. Two plans are under consideration by the company, one calling for construction of a central butane plant, the other for extension of service from the Phoenix plant.

According to late word received from the company, the first plan will most likely be carried out, the system being a high-pressure one, with regulators at the customers' premises. It is expected that there will be about 250 meters. The company plans to sell gas appliances in Glendale.

Merker in Charge of Market Research; Babcock Named Sales Manager

Herman Merker, secretary of Pressed Steel Tank Co., Milwaukee, Wis., has recently been placed in charge of market research and development for this company.

In the past, Mr. Merker has been responsible for a number of new markets for the products of the company, and his work has also resulted in the development of a number of new products. The Pressed Steel Tank Co.'s line consists of seamless and welded steel barrels, drums, tanks, cylinders and special shapes.

Mr. Merker, who until recently was both secretary and sales manager, has turned over the work of sales manager to P. T. Babcock, and will devote his entire time to secretarial and research duties.

Arizona Gas Co. to Install Butane Plant at Flagstaff

Arizona Gas Co. plans to begin construction of an air-butane plant at Flagstaff, Ariz., during the early spring months. The town, which has a population of 4,000, is located at a 7,000-foot elevation, making winter construction operations difficult. The company plans to install a high pressure distribution system at Flagstaff.

Arizona Gas Co., which was recently granted a franchise at Flagstaff, is a subsidiary of the Occidental Gas Securities Corp., Los Angeles, Calif., and H. G. Laub is manager for both companies.

Brokaw, Dixon, Garner & McKee Engineering Co., Inc., is Formed

Brokaw, Dixon, Garner & McKee announce the formation of a company to be known as Brokaw, Dixon, Garner & McKee Engineering Co., Inc., 120 Broadway, N. Y., for the purpose of engaging in the investigation, design, installation, construction and management of liquefied gas plants and distribution systems.

Management of the company will be under the direction of H. N. Witt, formerly vice-president of Thebo, Starr and Anderton, Inc., of San Francisco, identified with the rapid development of the liquefied gas industry on the Pacific Coast since its inception.

Brokaw, Dixon, Garner & McKee Engineering Co., Inc., has exclusive rights for the installation of Thebo, Starr and Anderton, Inc., plants in the east.

Stargas is Center of Attraction at Coryell County Fair

Unexpected glory for "bottled" gas was the result of the sudden failure of the electric lighting system at the Coryell county fair at Gatesville, Tex., where the Community Natural Gas Co. was exhibiting Stargas. Just as the crowd gathered to see the exhibits and to look over their programs, the grounds "blacked out" except for the exhibit of Stargas lights. The gas man in charge of the booth was kept busy answering questions about "bottled" gas for the remainder of the evening.

Completion of Nevada's First Butane Plant is Announced

Nevada Gas Co. recently began service of butane gas in Las Vegas, Nev., the first town in the state to receive the new fuel. The company is affiliated with the Lang Transportation Co. of Los Angeles, Calif., holder of the franchise.

The company serves undiluted butane gas through a low pressure distribution system. The plant was completed about the middle of October.

Butane Installation for Enrichment Being Completed at San Diego

San Diego Consolidated Gas and Electric Co., San Diego, Calif., has recently begun installation of five high pressure tanks for 75,000 gallons of butane for enrichment of the manufactured gas served by the company during peak load seasons. Oil gas of about 510 B.t.u. will be enriched with butane to 550 B.t.u. Included in the installation will be butane-air gas equipment of 3,000,000 cubic foot daily capacity for emergency use.

Construction Begun October 24 on Plant at The Dalles, Ore.

On Saturday, Octorber 24, ground was broken for the new plant at The Dalles, Ore., of Natural Gas Corporation of Oregon. When completed the plant will serve butane-air gas under high pressure. J. H. Lane has been appointed resident engineer for the company at The Dalles.

Two More Butane Plants for Central Hudson Gas & Electric Corp.

Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y., is planning construction of gas plants in New Paltz and Marlboro, N. Y. Butane-air gas will be served, the plants having a capacity of 156,000 cubic feet each.

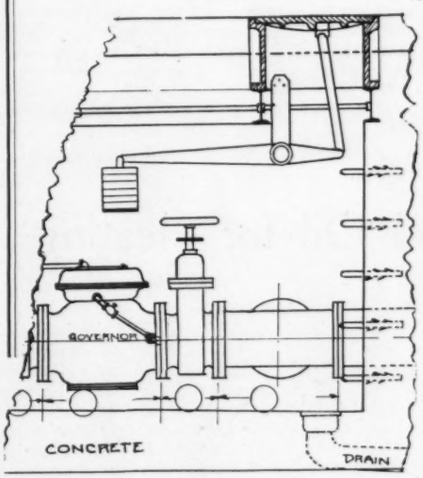
"STANDARD"
BU-GAS
A COMMERCIAL BUTANE OF EXCEPTIONAL PURITY

The high calorific value of Bu-Gas and its comparatively low vapor pressure result in economical storage and adapt it particularly—
FOR GAS MANUFACTURE OR ENRICHMENT—FOR PEAK LOAD PRODUCTION

Any Standard Oil Representative Will Gladly Furnish Full Information

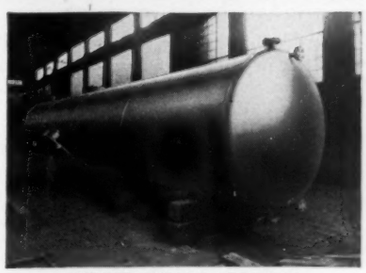
STANDARD OIL COMPANY OF CALIFORNIA

Connelly Iron Sponge & Governor Company



Counter-Balanced Manhole
Write for Bulletins
ELIZABETH NEW YORK
CHICAGO

.Biggs. Welded Vessels



WELDED BUTANE RECEIVERS

BIGGS Welded Butane Receivers effect a real economy by eliminating the maintenance trouble and expense usually encountered under severe working conditions. The Biggs weld is ductile, uniform, and stronger than the plate itself. Data upon request.

THE BIGGS BOILER WORKS CO., Akron, Ohio

Minnesota Northern's "77" Campaign

(Continued from Page 17)

Total reduction in price would be $59.29.

C—Try an auction. All bids must end in "77." Give merchandise to the highest bidder. Hold the auction on the 7th, 17th, 27th, 37th, etc., day of the Campaign.

D—Hold a contest among school children for the 7 best reasons why natural gas should be used for house heating, either in essay form, or "7 Reasons Why." Give prizes of $7.77, 77c, etc. Or you could ask for the 7 best uses for natural gas in a house.

E—When displaying merchandise in your windows, have the card writer place "7 reasons why" or "7 points of interest" on a card about the appliance.

F—Maintain customer interest at all times, in some way. If asked for a donation, donate $7.77, not $10.00. Paint a large "77" on your sidewalk in front of the store with white paint.

As an example of how the various divisions are falling in with the key idea of the campaign, all sections have formed organizations to aid their manager in the contest. One division has divided into 7 employee groups of 7 employees each. Another has 7 group captains reporting every 7 days. Another division has its three groups, for sales, accounting, and operation, reporting on the 7th, 17th and 27th of each month.

Each Monday morning during campaign dates the company is on the air over KFYR, Bismarck, in broadcasts announcing "77" features, asking listeners-in to visit company display floors.

Sale of company preferred stock shares is one important item in the campaign, and this phase, too, has been geared to the "77" idea. As stated earlier, 777 shares are the goal. Every employee is asked to interview at least 7 prospects for stock. A bonus of 77 cents above the regular commission is offered employees for each share sold.

To indicate how the individual appliance sales are built about the "77" idea, consider the conversion burner offer which is being made for the campaign. A conversion burner is sold at $47.77, completely installed, with down payment of 77 cents. A sales commission of $7.77 is allowed on each burner. And a special commission of $1.77 is set for each prospect's name furnished by a non-sales employee, providing the prospect is sold within 30 days from the time the name is reported.

A range model has been priced at $77.77 for the campaign.

In the above and numerous other special offers the campaign has been rounded out. While appliance and stock sales will naturally get a heavy share of the emphasis in all divisions, other aspects of "perfect service" will not be neglected. Safety meetings will be held, for example, to check over the careful observance of the company's existing safety practice regulations.

Sales quotas which play a part in the campaign are reasonable ones, and progress to date indicates that they will be met and exceeded. This will serve the immediate end of holding up sales for the final quarter of the year. But the campaign will accomplish a much more important end than consummating sales quotas. The coordinated effort for perfect utility service during the 77 days of the campaign will set up a momentum which should react to the good of the company during the whole of 1932.

LUCKY 7's !!!
The figure "7" has attached to its history a legion of interesting facts and stories:
In the Bible, we find the world was created in 6 days and the Lord rested on the 7th.
The three Hebrew festivals each lasted 7 days.
Egypt's 7 years of plenty are succeeded by 7 years of drought.
The golden candlestick in Solomon's Temple has 7 lamps.
The number "7" has been regarded by many nations as mystical and symbolical. Various reasons have been given for the peculiar regard had for this number, such as "the 7 is a symbol of completeness, being compounded of three and four"; "perfect numbers, they being representable in space by the triangle and the square."
In History we find:
The 7 Wise Men of Greece
The 7 Champions of Christendom
The 7 Days Battle during the Civil War
The 7 Weeks War in 1866
The 7 Years War in 1756 to 1763.
The 7 Wonders of the World
And so on
for 77 days, starting with October 1st and continuing to December 16th, 1931, the Montana Dakota Power Company will have interesting news for all its customers!
Montana-Dakota Power Co.

One of the effective pieces of advertising copy being used by Minnesota Northern subsidiary in the "77" campaign

Comparing Gas and Oil for Heating

(Continued from Page 32)

d. Waste. Fuel oil costs are increased by the amount of waste which is present in vaporization in storage, waste in handling and delivery, leakage and sludge wastes.

d' Gas has no waste, and if any leakage occurs it is immediately detected.

5. Cleanliness.

a. Oil is conceded to be a "messy" substance and no excuses are asked for or given when unsightly conditions exist, although these can generally be improved but not entirely eradicated. Cleanliness promotes efficiency.

b. Gas being without body, has no residue which in its original state could cause uncleanliness. It is a fact that in gas installations particular pride is taken in the appearance of the boiler rooms, and consequently more attention of a conscientious nature is given the burning of the fuel, and therefore a high expectation of combustion is realized. With oil used as a fuel the converse is the case. Cleanliness is also reflected in the personal appearance of the building maintenance and operating force, which in turn has the effect of attracting higher types of rentals, having better status and credit rating, with a consequent longer rental and higher rental factor for the building. This condition is also accentuated favorably through the use of gas as fuel because of its preponderant merits over oil, such as the maintenance of uniform temperatures, etc.

6. Maintenance of equipment.

a. The use of oil necessitates the use of equipment with its contingent moving parts, having a specified period of life according to intelligent use and imposed conditions.

b. The combustion of gas requires no fuel pumps, compressors, etc., and consequently maintenance and ultimate total replacement costs are eliminated.

7. Loss in preparation of fuel.

a. In oil storage for larger installations a steam line having a live steam circulation is used to maintain fluidity and a similar process is used for vaporizing the fuel so that it will be more susceptible to combustion. Whether the auxiliaries be operated by steam, electricity or other means, the cost of operation projected to fuel cost represents a large percentage of the total cost.

b. Gas requires a minimum of auxiliary apparatus and therefore there will be no perceptible increase in unit cost.

8. Hazard.

a. The hazard present in the handling of oil is considerable and increases greatly as the flash point of oil is lowered. The possibilities of flooding the combustion chamber, with consequent explosive hazard are always present.

b. While gas has similar hazards, they are not as pronounced as in the case of oil, because gas hazards are generally known and are given particular care and consideration.

9. Maintenance of continuous heating.

a. It is not an uncommon occurrence that with oil use, grit, sludge and other residue clog the orifice of the boiler burner and cause considerable inconvenience.

b. Gas has no residue grit and deteriorating elements and therefore more beneficial results can be expected.

10. Human factor.

a. Almost constant attention is required when oil is being used, to obtain the highest possible efficiency.

b. The element of chance is eliminated to a greater extent in the use of gas than with oil for greater combustion efficiency; therefore, a cost differential favoring use of oil would materially diminish when fuel burning characteristics are considered.

11. Investment costs and fixed charges.

a. Relative costs of oil burners and equipment are higher.

b. Oil in storage, tools, packing, lubricating oil and other requirements needed for oil operation represent a considerable figure.

12. Fire insurance rates.

a. Fire insurance rates are generally calculated for application according to inherent and externally existing hazards. With gas the regulations tend to reduce the fire insurance rate.

Summary

In the majority of cases, after considering the various factors, it will be readily seen that in the use of gas a considerable saving will be effected. If the monetary differences which may exist in the analysis between the two fuels should favor the use of oil rather than gas, the secondary and contingent factors will in most instances discount the existing differences.

United Development Co. is Incorporated at Caldwell, Idaho

The United Development Co. has been incorporated at Caldwell, Idaho, to engage in exploring for gas and oil. Incorporators are named as George Buhn, Boise; F. Lee Johnson, Boise; George Thorsen, Minneapolis, Minn.; Avery Harrison, La Grande, Ore.; and F. A. Jester, Boise.

In the big Chicago Line

Completion of the Continental Construction Corporation line by which Texas gas is brought almost a thousand miles to Chicago, is a real achievement for the industry. The entire system, comprising 1250 miles of pipe, is capable of delivering approximately 175,000,000 cubic feet daily and will serve industrial and domestic users in numerous towns and cities, in six different states.

Many factors entered into the accomplishment of such a tremendous undertaking. One of the most important of these was the availability of pipe adequate in diameter and strength, without excessive weight.

In pipe-line projects of magnitude, engineers and field men rely on the uniformly satisfactory working qualities, the unfailing strength and general durability of NATIONAL Pipe, established by impressive records from every important field. Such records account for a large portion of the Continental Line being composed of NATIONAL—

America's Preferred Line Pipe

NATIONAL TUBE COMPANY · Pittsburgh, Pa.
Subsidiary of United States Steel Corporation

NATIONAL PIPE

Lone Star Exhibit at State Fair Features "Buy in Texas" Theme

A facsimile of a silver dollar, 8 feet in diameter and 5½ inches thick, bearing the legend "93 Cents Stays in Texas," was a dramatic representation of what becomes of the gas consumer's dollar shown in the Texas State Fair exhibit of the Lone Star and affiliated companies in Dallas late in October.

The dollar is supported on steel braces above a panel 50 feet long, bearing the name "Lone Star Gas Co." in letters 8 feet high.

It is made in perfect proportion to an ordinary dollar, with its bevelled edges milled around. Five figures divide the space proportionately to show for what the 93 cents is expended, including labor, materials, supplies, etc.

Bureau of Standards Issues Bulletin on Domestic Burners

The United States Department of Commerce, Bureau of Standards, has recently issued circular No. 394, giving general information on the design of gas burners for domestic use. The reader is supplied with certain approximate formulas and general advice which may be used as a guide in designing or modifying a burner for a particular set of conditions of service. Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each.

Santa Anna Gas Co. Serves Coleman

Santa Anna Gas Co. has begun domestic service in Coleman, Texas. The town is also served by the Coleman Gas & Oil Co.

"Consider these features of the ALCO magnetic gas valve."

Quiet—Inexpensive—Will not leak—Packless—Power consumption only 12 watts—Furnished for high or low voltage A. C. or D. C.—Sizes ½"-1½" inclusive.

These are the features that make the Type SG Valve an ideal control for domestic gas burners using either natural or manufactured gas. Used in connection with any standard thermostat, this valve provides a very satisfactory though inexpensive control.

The Type SG Valve can be furnished with an emergency hand operation feature and a pilot light fitting if desired.

Detailed information is contained in our Bulletin No. 112 sent upon request.

ALCO VALVE COMPANY, INC.

MAIN OFFICE AND FACTORY: 2641 BIG BEND BOULEVARD, MAPLEWOOD BRANCH, P. O. ST. LOUIS, U. S. A.
New York, Philadelphia
Represented by Pacific Scientific Company
Los Angeles, San Francisco

Newman Gas Equipment Co.

Industrial and Commercial Burners

Upshot Burners for Ideal Boilers

Bailey Regulators for Gas Fuel and Pressure Regulation

447 Sutter Street San Francisco Ph. GA 7833

B. F. Pickard Appointed to Post As Vice-Pres. of Oklahoma Natural

B. F. PICKARD, executive assistant of the Oklahoma Natural Gas Corp. since 1930, has been promoted to vice-president, it was announced by E. A. Olsen, president of the company. Mr. Pickard's promotion is effective immediately.

B. F. Pickard

Mr. Pickard, who has been in public utility work since 1909, will handle practically the same duties as he now performs, which are direct supervision over all business operations.

He began a public utility career with the North Carolina Public Service Co. at Greensboro and was soon placed in charge of new business. From 1913 to 1915 he was assistant sales manager of the Ruud Manufacturing Co. with headquarters in Baltimore. At the end of 1915 he returned to North Carolina. There he assumed charge of all activities of the company.

During the war he served overseas with the A.E.F. and at the close of the war he went back to his North Carolina post until 1925. Then he became connected with Southern Gas and Power Co. with headquarters in Philadelphia. He helped organize and operate 18 subsidiary companies. He went to the Whetstone Utility Managing Corp. in 1926 and managed all the southern properties and until late in 1929 worked for other utilities in the south in a similar manner.

He then spent several months in utility management in Europe and the West Indies until late in 1930, when he joined the Oklahoma Natural organization.

Franchise Extension Granted at Salina to Kansas P. L. & Gas Co.

Kansas Pipe Line & Gas Co., Salina, Kan., has been granted a 10-year extension of its gas franchise in Salina. The franchise has 8 years yet to run, and the city will receive $2,000 per year for the coming 8 years. If the city does not purchase the gas system at the end of the period then one per cent of the gross receipts of the company will be paid for the next 10 years which the franchise runs.

Smith Named District Supervisor; Lott, Office Manager, at Longview

R. R. Lott has been appointed office manager for the United Gas Public Service Co. at its Longview, Texas, office. Mr. Lott succeeds W. N. Wells. J. J. Smith has been appointed district supervisor with headquarters at Longview. United Gas Public Service Co. maintains headquarters at Houston, Texas.

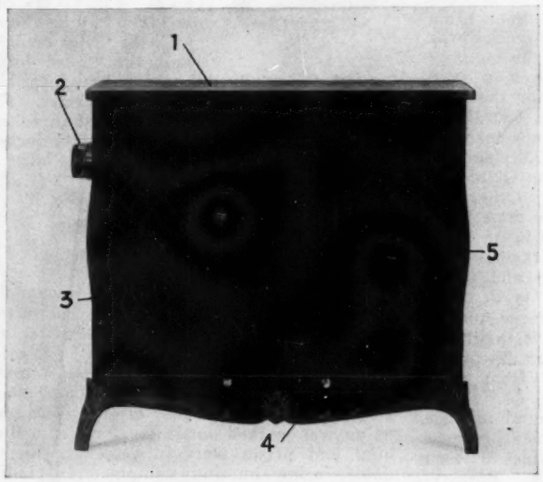
Line from Macomb to Cuba, Ill. Completed in October

Completion was expected early in October on the 27-mile high pressure gas transmission line constructed by the Central Illinois Public Service Co. between Macomb and Cuba, Ill. The line was constructed under the supervision of S. E. Nims, gas engineer for the company, headquartered at Springfield.

Announcing

The HUMPHREY Ambassador

AUTOMATIC GAS-ELECTRIC HEATER



1—Heavy gauge shielded steel cabinet. 2—Thermostat. 3—Room air intake grill. 4—Pilot port. 5—Warm air outlet—fan-forced circulation.

ARTISTIC in design, the Ambassador blends with the finest home furnishings. Constructed on the proven principle of high heating efficiency through forced air circulation by the use of a fan, it sets a new standard of heating comfort that can be replaced by no other equipment.

The first public showing of the Ambassador was during the P. C. G. A. Convention in San Francisco. It attracted widespread attention, and its immediate public acceptance was convincingly demonstrated.

Send today for complete information on this new Humphrey product.

NOW the famous Humphrey Gas Unit heating principle has been applied successfully in a beautiful heater for homes, offices, stores, and shops, and once again the General Gas Light Company opens a new gas market for you. The Humphrey Ambassador is an auxiliary heating unit for Fall, Spring and the extremes of Winter, as well as for complete house heating in the warmer climates. It is entirely automatic, with self-contained thermostatic control, fan-forced combustion and warm air circulation to bring instant uniform heat throughout the room in which it operates.

General Gas Light Company
Kalamazoo, Michigan

C. B. Babcock, Pacific Coast Manager, 135 Bluxome St., San Francisco

Natural Gas Industry Reports Gains

(Continued from Page 29)

important class of industrial consumption, increased from 261,107,000,000 cubic feet in 1929 to 266,625,000,000 cubic feet in 1930. This gain, while important, was much less than that recorded in 1929.

The total consumption of natural gas as fuel under stills and boilers at petroleum refineries in 1930 amounted to 98,842,000,000 cubic feet, a decline from the previous year of 4,887,000,000 cubic feet, or 5 per cent. The decline in the use of natural gas as refinery fuel was fairly general and resulted chiefly from a decrease in the quantity of crude oil processed.

The consumption of natural gas by electric public utility power plants amounted to 120,290,000,000 cubic feet in 1930, an increase over 1929 of 7 per cent. This figure constitutes a new record for this class of consumption, although the percentage increase was much below that of 1929. Natural gas is used by public utility plants in 18 States; the two most important consumers are Texas and California.

The consumption of natural gas by Portlant cement plants in 1930 remained practically unchanged from 1929; the total in 1930 was 41,256,000,000 cubic feet, as compared with 41,643,000,000 cubic feet in 1929. During 1930 natural gas was used as fuel at 28 Portland cement plants located in 10 States, as follows: Alabama, Arkansas, California, Colorado, Kansas, Missouri, Nebraska, Oklahoma, South Dakota, and Texas.

The heading "Miscellaneous Industrial Consumption" covers consumption of natural gas by steel plants, glass works, ice plants, brick and terra cotta establishments, and many other industries where the absolute control of temperature is absolutely necessary. A total of 315,059,000,000 cubic feet was consumed by the miscellaneous industries, a decline of 5 per cent from 1929.

55,020 Producing Wells

The approximate number of producing gas wells, as of December 31, 1930, totaled 55,020, an increase over the previous year of 1,475. The total number of gas wells completed in 1930 amounted to 2,866, which indicates that there were about 1,400 gas wells abandoned during the year. Pennsylvania, with nearly 20,000 producing gas wells on December 31, 1930, again ranked first; West Virginia, with 12,983 gas wells, was again second. The small average size of the gas wells of the eastern States makes it imperative to have a large number of wells upon which to draw and necessitates the drilling of many new wells—thus, while the States east of the Mississippi produced only 18 per cent of the total output in 1930, they had 81 per cent of the producing gas wells as of December 31, 1930, and were credited with 51 per cent of all the gas wells brought in during the year.

The number of gas wells completed during 1930 amounted to 2,866, a decrease of 4 from the 1929 total. This figure does not include completions in California, for which State the record is lacking. However, the number of strictly gas wells in California is comparatively small. Ohio, with 653, was again the leading State in number of gas-well completions in 1930. This figure represents a material decline from 1929; nevertheless, the State showed a gain of 9 per cent in output. Texas, Oklahoma, and West Virginia, with 483, 403, and 397 completions, respectively, followed Ohio in rank. Of these, only Oklahoma showed an increase in production over 1929.

Interstate Transportation

The interstate transportation of natural gas has shown a rapid growth in recent years, particularly in 1929, when several large lines traversing several States were completed. In 1930 the growth in interstate deliveries was more conservative; nevertheless, the quantity transported between States showed a gain over 1929 of 17 per cent, and for the year amounted to 380,600,000,000 cubic feet.

The largest single interstate movement of gas was again that from West Virginia to Ohio, although the movement from Oklahoma to Kansas was almost as large. Other important interstate deliveries were those from Kansas to Missouri, from Kentucky to West Virginia, from Louisiana to Arkansas and Texas, from Texas to Colorado and Oklahoma, and from West Virginia to Pennsylvania. The States which have large quantities of excess gas over and above their consumption are Louisiana and West Virginia; hence the interstate movement from these States is large.

It is difficult to estimate the total mileage of the natural gas pipe lines, chiefly because there is no definite dividing line between trunk lines and gathering lines. Furthermore, it is virtually impossible to ascertain when work on new lines was started and completed. However, it is believed that as of July 1, 1931, there were approximately 50,000 miles of natural gas trunk lines in the United States, as compared with 40,000 miles the previous year.

Although the number of large pipe line systems completed in 1930 probably fell below the 1929 record, the number of individual projects undoubtedly showed an increase and the total mileage laid was possibly higher than in 1929.

McMurray Heads Timken Michigan Leak Clamp Division

F. A. McMurray, who was formerly assistant to the president of the M. B. Skinner Co., has been appointed sales manager of the Leak Clamp Division of the Timken Michigan Co. His headquarters will be 1006 Burnham Building, Chicago.

Mr. McMurray is a member of the American Gas Association and has for the last two years been a member of the Association's Pipe Joint Committee.

The Timken Michigan Co. is offering a new leak clamp with many new features, and Mr. McMurray's department will have charge of introducing this clamp to the industry.

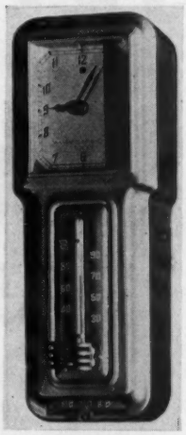
Southwestern Development Co. Moves Headquarters to Amarillo

Southwestern Development Co. has moved its headquarters to Amarillo, Texas, from Independence, Kan., and has placed R. E. Wertz in charge. Mr. Wertz will continue in his work as president of the Amarillo Gas Co., which is a subsidiary to Southwestern Development Co.

San Diego Adds 6,604,000 c.f. Commercial Load in August

San Diego Consolidated Gas and Electric Co., San Diego, Calif., reports that new gas commercial heating business added during August will result in an estimated annual consumption of 6,604,000 cubic feet. Gas space heating added an estimated annual consumption of 997,000 cubic feet. These figures compare with 3,378,000 and 264,000 cubic feet estimated annual consumption added in August, 1930.

Electric Clock-Thermostat By Minneapolis-Honeywell Co.



MINNEAPOLIS-Honeywell Regulator Co., Minneapolis, Minn., announces the manufacture of a new thermostat with self-starting synchronous electric clock, operated from the house lighting circuit. The new device will move the thermostat temperature indicator to a lower setting at night and will restore the day-time temperature setting when desired.

Special features of the clock thermostat are the "Week-end and Holiday Shut-off," the "Nite Switch" and the "Low Limit Control Cut-out." All models are furnished with separate low voltage transformer. The adjustable range is 55° to 85° Fahrenheit. Over-all dimensions are: height, 7¾ inches, width 2-13/16, depth 2⅜ inches. Finish is of silver.

197 Ranges Sold in Northern States Power Co.'s Campaign

Northern States Power Co., Minneapolis, Minn., announces the successful completion of a gas range sales campaign under the direction of Louis Stein, director of gas sales. Over the period of a month, sales crews exceeded their quota of 164 ranges by about 20 per cent, selling a total of 197. The campaign was worked out in the form of a duck hunt and prizes were in keeping with the motif, being hunting equipment, including guns, knives and wearing apparel. The La Crosse, Wis., division of the company came in first with 39 sales to its credit.

Arkansas Valley Natural Gas Co. to Serve More Colo. Towns

Arkansas Valley Natural Gas Co., Rocky Ford, Colo., has been granted franchises in Ordway and Sugar City, Colo. Service will be extended from Rocky Ford to the towns, supply coming from the Amarillo-Denver line. The company is now conducting a survey for the line route.

Tobin Now Supt. Gas Distrib. for Western United G. & E.

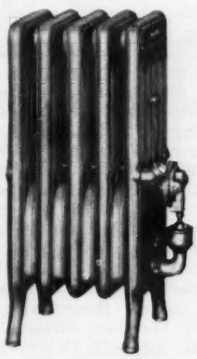
H. H. Tobin has been appointed to the position of superintendent of gas distribution of Western United Gas & Electric Co., Aurora, Ill., taking the place of A. G. Ford. The company is a subsidiary of Western United Corp.

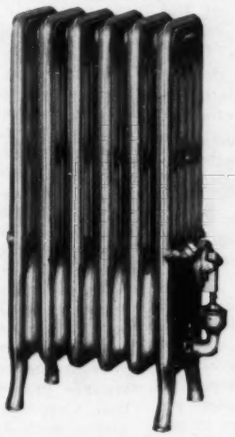
Winterset Being Served Texas Gas

Winterset, Iowa, is being served with gas from the main line of the Continental Construction Corp. from Amarillo to Chicago. Iowa Power & Light Co., headquartered at Des Moines, distributes the gas.

Pacific Radiator Outstanding Gas Heating Achievement

26" and 32" heights, in as many sections as required





A Quality Product

Materials and workmanship of Pacific Gas-Steam Radiators are guaranteed to be of the highest grade, and free from defects. Radiator sections, burners, regulator housings, and air mixers are carefully selected, accurately machined grey iron castings. Every Pacific Gas-Steam Radiator, like other products of this firm, is tested and adjusted to actual operating conditions before leaving the factory.

Radiator Section

Now Is the Time to Install It

THE PACIFIC Gas-Steam Radiator meets every ideal of architect, builder, and owner. Greater radiation surface of the 5-column design gives improved efficiency, faster heating, and greater beauty. Steam pressure and gas consumption are automatically controlled. Write for full details on this profitable, easy-to-sell item.

Pacific Gas Steam Radiators have been selected for the Los Angeles City Schools and High Schools, meeting very exacting requirements and rigid specifications, including safety, economy and efficiency of operation, and stability of construction.

Outstanding Features

Each radiator section and combustion chamber is a single-unit Casting. Burner extends full length of radiator, under exact center of water chamber, developing maximum steam in minimum time. Burner cast in one piece, without joints or welds. Double-disc diaphragm regulator gives positive control of gas and steam pressure. The owner has nothing to do but light burner, and this radiator provides quick, healthful heat, automatically controlled and requiring no attention whatever after it is turned on.

A. G. A. Approval

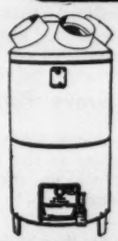
The laboratory seal of American Gas Association appears on every Pacific Gas-Steam Radiator, assurance that it has met basic national safety requirements. Also approved by Underwriters' Laboratories.

Pacific Gas Radiator Company

Gas Heating **Headquarters**

Roseberry and Walter Streets
Huntington Park California

Gas-Steam Radiators



Round Furnaces

Dual Pipeless Furnaces

Fireplace Radiant Heaters

Recess Radiant Wall Heaters

Automatic Storage Hot Water Heaters

Pipeless Floor Furnaces

Gas Radiators — Pressed Metal and Cast Iron

Agencies Throughout the West

Call for a Pacific Heating Engineer

MANUFACTURERS *of* EVERY TYPE *of* GAS HEATING APPLIANCE

Reorganization of Tri-Utilities Corp.

THE plan for reorganizing Tri-Utilities Corp., announced October 6, is designed to keep intact the entire system and to protect the holders of all securities concerned. Through its subsidiaries, the corporation controls properties valued at approximately $320,000,000, which supply natural and manufactured gas, water, electric light and power, to 663 cities, towns and numerous rural communities located in 26 states and having an aggregate population of over 4,750,000. The plan was formulated by a reorganization committee consisting of Richard C. Hunt, of Chadbourne, Hunt, Jaeckel & Brown, chairman; William Buchsbaum, and Medley G. B. Whelpley, president of the American Express Bank & Trust Co. C. E. Sigler is the secretary of the committee, and Larkin, Rathbone & Perry, and Chadbourne, Hunt, Jaeckel & Brown are counsel. No member of this committee has any financial interest in the system. The plan calls for the formation of a new company and the exchange of securities of the new company for those of Tri-Utilities Corp. and its subsidiaries.

Assuming the complete exchange and sale of securities, as prescribed in the plan, and the carrying out of other provisions, the new company will own directly or indirectly all outstanding securities of Federal Water Service Corp. except its convertible 5½ per cent gold debentures; all outstanding securities of Peoples Light and Power Corp., except its first lien 5½ per cent gold bonds and the five per cent convertible gold debentures; all outstanding securities of Southern Natural Gas Corp., except its first mortgage 6 per cent sinking fund gold bonds of which a substantial amount will be owned; more than 99 per cent of the outstanding common stock of Oklahoma Natural Gas Corp.; and all outstanding securities of Power, Gas and Water Securities Corp., except the latter's collateral trust 5 per cent gold bonds.

The reorganization committee may declare the plan operative before the complete exchange of securities above indicated is effected.

Results which the organization of the company is intended to accomplish are: Reduction of fixed charges; simplification of the system's capital structure; provision of funds for additional working capital and for necessary plant extensions and improvements; and greater unification of the system's properties under a centralized management.

In a letter to the reorganization committee dated September 1, 1931, Loeb & Shaw, Inc., engineering firm engaged to make a thorough study of the properties, operations and capital structures of Tri-Utilities Corp. and its subsidiaries and affiliated companies, reported that the physical properties are in excellent condition.

North Platte Gets "Natural" From Reconditioned Oil Carrier

Natural gas was turned on in North Platte, Neb. on October 19, according to word received from the Northwestern Public Service Co., serving the town.

Kansas Pipe Line & Gas Co., of Salina, Kan., recently completed construction of connecting lines between North Platte and the Stanolind oil carrier which is now leased and reconditioned for gas. Supply comes from the line of the Kansas Pipe Line & Gas Co. from Texas and Kansas fields, the oil line conecting with the main line at a point near Kearney.

Northwestern Public Service Co., formerly serving manufactured gas in the town, buys the fuel at the city gates from the pipe line company.

The new lateral, after connecting with the reconditioned oil line north of the city, crosses the river on the highway bridge and then runs east along the river to a point north of the present gas plant, where it enters the city limits. Kansas Pipe Line & Gas Co. maintains a measuring station at the town border.

Gas Service for Las Vegas N. M., Postponed Until 1932

The Las Vegas city council, Las Vegas, N. M., has granted the Albuquerque Natural Gas Co., Albuquerque, an extension of 10 months in which to complete the natural gas line to Las Vegas and begin service. The extension taps the Albuquerque-Santa Fe line at a point near Santa Fe.

C. D. Reasor District Manager for Western Power, Light & Telephone

C. D. Reasor has been appointed district manager of gas and electric properties of the Western Power, Light & Telephone Co. in Oklahoma and Kansas, according to an announcement made by D. C. Tinker, general manager of the company for such properties. Mr. Reasor succeeds Frank M. Guild, who, for some time past, has been district manager of the Western Light & Power Corp. in Kansas. Mr. Reasor's headquarters will be in Harper, Kan., and he will have under his direction the field activities of the Western Light & Power Corp. in Kansas and Oklahoma, the Western Natural Gas Co., the Winchester Oil & Gas Co. and the gas pipe line companies which supply the companies named.

City Commission Refuses Rate Reduction at Abilene, Texas

The city commission of Abilene, Texas, recently declined to pass a rate reduction ordinance after many months of discussion and investigation. This action followed a session of the commission at which Chester L. May, vice-president of the Community Natural Gas Co., explained the company's situation and presented facts and figures indicating that the company was not making sufficient returns to permit it to make a reduction. Members of the commission and others questioned Mr. May on every angle of the business and appeared convinced that the gas company, like every other business, was suffering large losses, and also was faced with the necessity of maintaining uninterrupted service.

Ready's Report on "Natural" for San Diego to be Submitted in Nov.

Lester S. Ready, retained by the San Diego Calif., city council to investigate the possibilities of natural gas for that city, is expected to make his report to the council early in November. Mr. Ready's investigation is concerned chiefly with investment costs and rate schedules at which the natural product might be served.

It is understood that the project of taking "natural" to San Diego would involve the laying of about 95 miles of transmission line from Long Beach, Calif., to tie in with San Diego Consolidated Gas and Electric Co.'s present system, through which manufactured gas is now being served.

Illinois Northern Utilities Co. Extends Service Area from Sterling Plant

ILLINOIS Northern Utilities Co., Dixon, Ill., is preparing to begin service in Polo, Mt. Morris and Oregon, Ill., through a transmission line from Sterling, Ill., central plant. The extension was made from Dixon which is connected with the Sterling plant by a 6-inch transmission line, the company laying 15½ miles of 4-inch welded main for the newly completed carrier.

Distribution systems to carry gas at from two to five pounds pressure are being installed in each of the three cities, the one in Polo having been completed.

Service will be rendered to approximately 700 new customers upon completion of the three systems. with an expected increase to 1,000 customers during the coming winter season. Merchandising of the principal appliances will be carried on through the company's stores at the several local offices. H. E. Harnish is district superintendent with headquarters in Oregon, with Wayne Prince as local superintendent at Polo and Carroll Boston, local superintendent at Mt. Morris.

With the completion of the Geneseo-Milwaukee branch of the Continental Construction Corporation's carrier, these cities, together with Geneseo, Mendota, Dixon, Sterling, Rock Falls, Morrison, De Kalb, Sycamore and Belvidere, will probably be served with natural gas from that source.

Gas For Lafayette, La., in November from United's Line

Louisiana Public Utilities, Inc., expects to turn natural gas into its system at Lafayette, La., about November 1, according to a statement credited to E. R. Bodemuller, general manager for the company at Lafayette. Supply for the town comes from United Gas Public Service Co.'s Kirbyville-Franklin carrier, recently placed in service.

Bow Island Natural Gas Inc. Gets Montana Permit

The Bow Island Natural Gas Inc. of Great Falls, Mont., has been issued a permit by the Secretary of State to carry on a general gas and petroleum business in the state of Montana. Capital stock is listed at 500,000 shares of no par common. Directors are named as Paul Murphy, R. W. Mason, C. T. Busha, L. J. Molumby and P. G. Greenan, all of Great Falls.

Northern States Power Co. Reports Gain in Gas Sales

Northern States Power Co., Minneapolis, Minn., reports that total gas appliance sales in 1931 up to August 31 amounted to $21,291 more than in the same period of 1930, or a gain of about 16 per cent.

Locust Grove Permit Granted

Locust Grove, Okla., has granted a natural gas franchise to the Braman Oil Co., Tulsa, Okla. Work on the system is expected to begin at once.

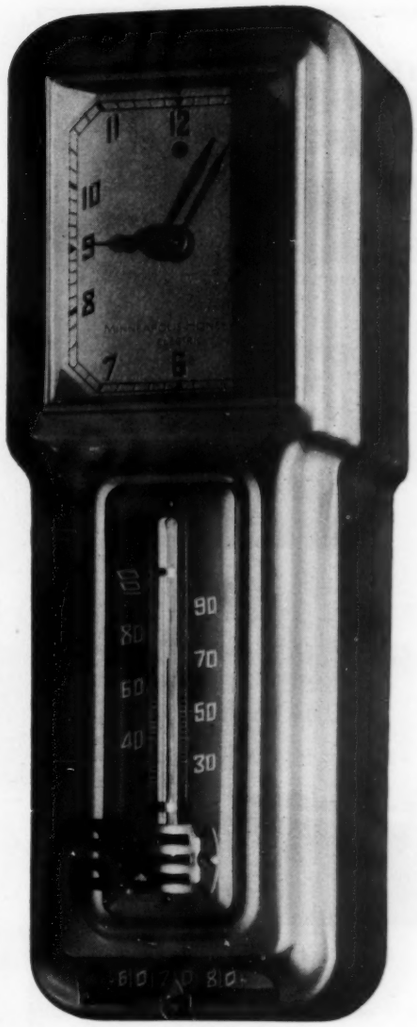
Line to Cedar Vale, Kan., Begun

Work was begun on October 2 on the natural gas line to serve Cedar Vale, Kan. Glenn W. Leighty, Cedar Vale, is holder of the franchise.

It's here!

The Minneapolis-Honeywell

Electric Clock Thermostat



Climax of 47 years leadership in heat control engineering . . . Brought to a high point of perfection by Minneapolis-Honeywell research engineers . . . Ready now to help increase gas house-heating sales

We are happy to announce the introduction of the first absolutely silent electric clock thermostat, the Minneapolis-Honeywell Electric.

As you may know, work on the development of this design has been going forward in the Minneapolis-Honeywell research and testing laboratories for nearly three years. Various models, representing various stages in development have been out on test on domestic heating plant installations.

Now the job is finished. The Minneapolis-Honeywell Electric is ready to be a standard control unit for your heater. Its importance to you can scarcely be overestimated. Its novelty alone gives you a potent-selling feature. Its superiority of design, construction and operation gives you a sales-clinching edge over competition. Your customers will not trouble you for the unnecessary service calls caused by their failure to wind the clock, because this thermostat's clock is *automatically self-starting*.

The Minneapolis-Honeywell Electric, worthy product of the leading automatic heat control engineering organization, is ready now to help you increase house-heating sales. Investigate at once. Write or wire the nearest Factory Branch or Distributor for complete information.

Minneapolis-Honeywell Regulator Company. *California Branch:* 557 Market St., San Francisco, California. *Distributors:* Portland Seattle, Los Angeles, Salt Lake City, Denver.

DISTRIBUTORS: *North Coast:* Arthur F. Erickson Co., 315 Selling Bldg. Portland, Ore., 816 Terminal Sales Bldg., Seattle, Wash. *Southern California:* English & Lauer, 1224 South Pedro St., Los Angeles, Calif. *Denver:* Daly Company, 1635 Blake St., Denver Colo., *Salt Lake City:* Hawley-Richardson-Williams Co., 204 Dooly Bldg., Salt Lake City, Utah.

These advantages of the Minneapolis-Honeywell Electric make it today's outstanding domestic heat regulator

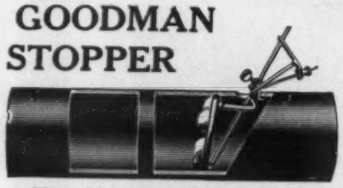
1. Absolutely silent—no motor noise — no noise when thermostat shifts from day to night setting.
2. Self-starting 60 cycle synchronous motor runs at less than 1/10 the speed of ordinary electric clock motors.
3. Pleasing, modern design—the best looking clock thermostat on the market.
4. Week-end and Holiday Shut-off and Nite Switch features are available.
5. No winding, no forgetting — as dependable as electric power.

THE MINNEAPOLIS-HONEYWELL

ELECTRIC

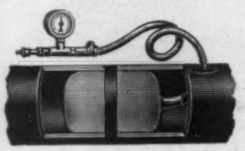
Silent, dependable electric clock control for home heating

THE
GOODMAN
STOPPER



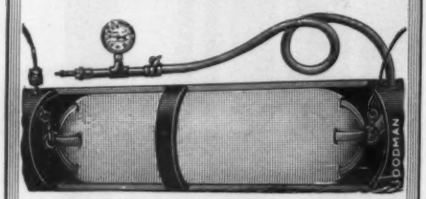
WHEN LOCKED IN PLACE IT HOLDS

DEPENDABLE GAS
MAIN BAGS



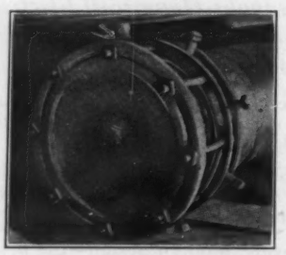
Type C

GOODMAN CYLINDRICAL
STOPPER FOR INTER-
MEDIATE PRESSURE



Increased Length for Increased Pressure

KRUPA-HENDRY
TEST CAP



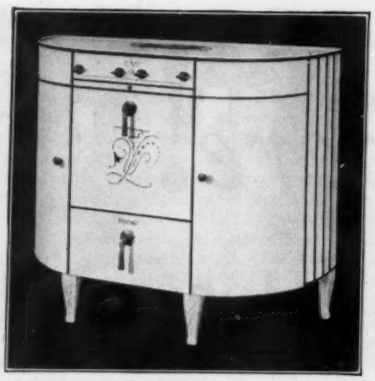
For Testing High Pressure Lines

SHIPMENTS FROM STOCK

SAFETY GAS MAIN
STOPPER COMPANY

523 Atlantic Avenue
BROOKLYN, N. Y.

Pac. Coast Rep.: C. B. Babcock Co.
135 Bluxome Street, San Francisco
California



"Vanity" Model with cooking top cover and side cabinets closed.

The new range showing utensil cabinets and cooking top open.

"Vanity" Model Range Announced by Moore Brothers

MOORE BROTHERS CO., Joliet, Ill., announces the production of a new model gas range called the "Vanity." Outstanding new features of the range are the circular design, cooking top cover which acts as a back splasher when the stove is open, the utensil cabinet at either side of the oven, containing 10,500 cubic inches of storage space and gliding broiler drawer with raising and lowering device.

Following are the specifications:

Width over all	42 inches
Height cooking top	36 inches
Oven	16 x 19 x 13 inches
Broiler Drawer	16 x 19 x 9 inches
Top	800 sq. in.
Storage Compartments (each side)	Width 10 inches
Depth on oven side	21 inches
Depth on outside	10 inches
Total storage space	10,500 cu. in.
Shipping weight	350 lbs.

The frame, main front, oven and broiler door frames, cooking top, grates, burners and legs are of cast iron.

The new range may be obtained either in ivory or ocean green porcelain enamel.

Colorado Springs Conversion to Natural Gas Complete

Conversion of Colorado Springs distribution system to natural gas from manufactured gas is now complete, according to reports received from the district. Gas is being delivered to the City Light and Power Department by the Colorado Interstate Gas Co. from the Amarillo-Denver carrier.

Following are the rates for the new service:

First 400 cu. ft. or less used per month	$0.90
Next 600 cu. ft used per month, per 100 cu. ft	0.15
Next 1,000 cu. ft. used per month, per 100 cu. ft.	0.12
Next 1,000 cu. ft used per month, per 100 cu .ft.	0.075
Next 7,000 cu. ft. used per month, per 100 cu. ft.	0.06
Next 90,000 cu. ft. used per month, per 100 cu. ft.	0.05
Next 400,000 cu. ft. used per month, per 100 cu. ft.	0.025
Next 500,000 cu. ft. used per month, per 100 cu. ft.	0.02
Next 1,000,000 cu. ft. used per month, per 100 cu. ft.	0.018
Next 1,000,000 cu. ft. used per month, per 100 cu. ft.	0.016
Excess cu. ft. used per month, per 100 cu. ft.	0.015

Engineering Research Bulletin No. 21 Off the Press in October

The Department of Engineering Research of the University of Michigan, Ann Aabor, announces the publication of Engineering Research Bulletin No. 21, on "The Influence of Atmosphere and Temperature on the Behavior of Steel in Forging Furnaces," by D. W. Murphy, research associate, and W. E. Jominy, formerly research engineer with the Department of Engineering Research of the University of Michigan. The book was sponsored by the Committee on Industrial Gas Research of the American Gas Association, F. J. Rutledge, chairman.

Price of the publication is $1, and copies may be obtained by addressing the University.

American Gas Products has New Sales Set-Up in California

D. I. Murphy will handle the sale of Ideal Arcola gas boilers in northern California and the Pacific Northwest. Headquarters for this area will remain in the San Francisco office.

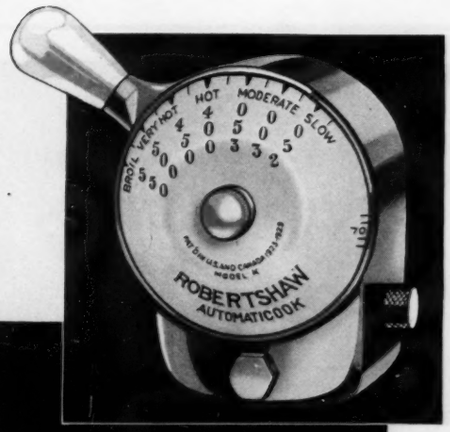
Gas boiler sales in southern California are now being handled by C. S. Rood out of the Los Angeles office. The Ideal Arcola gas boiler is manufactured by the American Radiator Co., and distributed by the American Gas Products Corp.

Snohomish Being Served from Everett Plant; Testing Completed

Washington Gas and Electric Co., on October 15 completed testing and putting into commission the gas distribution mains in Snohomish, Wash., which have been idle for two years. The company completed the reconditioning of the line from the Everett plant late in September.

Western Service Corp. Begins Service at Guthrie, Okla.

Natural gas was turned into the mains of the Western Service Corp. at Guthrie, Okla., recently through a newly completed gas distribution system. The supply comes through a pipe line constructed by the company from the Oklahoma City field to Guthrie.



You know you're right

"Her kitchen worries are where they belong"

Because 155 Manufacturers Can't be Wrong!

When the ranges you handle have the Robertshaw you know you have the best performing ranges in the country.

And you are doubly sure of that fact when you consider that 155 range makers now use the Robertshaw.

There *is* a record! Proof positive that the Robertshaw *commands* the approval of the vast majority of range makers.

Cheaper control devices can be made, but the many manufacturers who use the Robertshaw are not going to take any chances on the vital matter of automatic oven control . . . the big feature in range making that is selling ranges today.

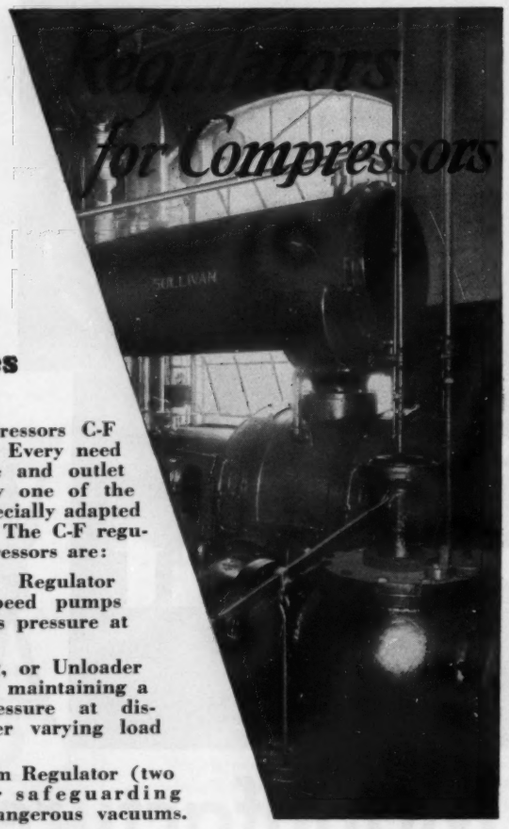
And the public knows the preference for the Robertshaw just as well as the manufacturers. Robertshaw advertising has brought the message of kitchen freedom to American housewives so strongly that it is the first thing most range buyers ask about these days.

Don't you want to cash in on this advertising at once? Just drop us a line and we will give you the complete Robertshaw program of magazine and radio advertising..the greatest single force in making new range sales for you today.

ROBERTSHAW THERMOSTAT COMPANY · YOUNGWOOD, PA.

ROBERTSHAW

AutomatiCook



C-F

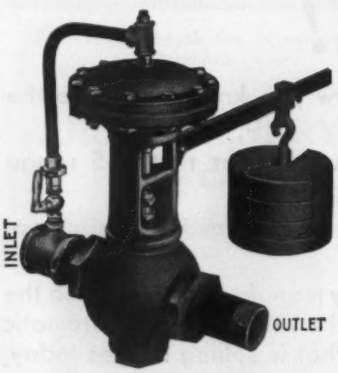
give dependable regulation of suction and discharge pressures

FOR gas or air compressors C-F Regulators are ideal. Every need for regulation on intake and outlet lines is provided for by one of the three C-F regulators especially adapted to compressor service. The C-F regulators used with compressors are:

(1) C-F Compressor Regulator for constant speed pumps to relieve excess pressure at the discharge.

(2) C-F Throttling, or Unloader Regulator for maintaining a constant pressure at discharge under varying load conditions.

(3) C-F Vacuum Regulator (two types) for safeguarding against dangerous vacuums.



Write for descriptive literature.

THE CHAPLIN-FULTON MFG. COMPANY

28-40 Penn Avenue Pittsburgh, Pa.

Organized 1884—Oldest Builders of Gas Regulators in the country. Built in all Sizes from 1 Inch to 24 Inches; For All Service 1 oz. up to 2,000 lbs. Pressure to Square Inch.

REPRESENTATIVES:
WESTCOTT & GREIS, Inc.
Sales and Service
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JNO. W. CRAWFORD
Sales Engineer
1855 Industrial Street, Los Angeles
Or Any Jobber

We Can Deliver to West and Southwest Equally as Low in Price as in Middlewest

LUX PURIFYING MATERIAL

MOST ECONOMICAL BECAUSE
MOST EFFICIENT
ALSO LASTS LONGER
QUICK DELIVERY

THE ALPHA-LUX CO., Inc.

192 Front St., New York City. Branches: Philadelphia, Chicago. Storage Base: New Orleans

International Conference on Coal to Have Broad Program

PAPERS contributed by scientists of 15 nations are listed in the preliminary program of the Third International Conference on Bituminous Coal which will be held November 16 to 21 in Pittsburgh, Pa. The tentative program is announced by Dr. Thomas S. Baker, organizer of the meeting and president of the Carnegie Institute of Technology, under whose auspices the world gathering of fuel technologists is being held.

The list of papers shows that almost every phase of coal utilization and related fields will be treated. The group of speakers includes scientists who are recognized as authorities in the several fields of coal research.

Natural gas will come in for its share of discussion in the addresses of several scheduled speakers. Dr. W. T. Thom, Jr., of Princeton University, will speak on "The Interrelationships of Coal, Petroleum and Natural Gas." R. B. Harper, vice-president, Peoples Gas Light & Coke Co., Chicago, will give an address on "Competition Between Natural Gas and Coal," and G. I. Rhodes of Ford, Bacon & Davis will speak on "Natural Gas and Bituminous Coal." There will also be many papers and discussions on gasification of coal.

Load-Building Campaign By Oklahoma Natural Succeeding

According to W. Jennings Young, new business manager for Oklahoma Natural Gas Corporation, Tulsa, the employee bonus plan for promoting gas sales had increased the company's revenue by about $6,000 when the plan had been in operation one month.

The plan, known as "Employees' Dealer Cooperative Load Building Campaign," was inaugurated September 15. By October 15, employees had submitted a total of 737 prospects, of which 133 were sold gas appliances through dealer-company cooperation. A total of 15,224 M.c.f. yearly has been added to Oklahoma Natural's load.

Gas and Oil Map of New Mexico By State School of Mines

The New Mexico Bureau of Mines and Mineral Resources announces the publication of an oil and gas map of New Mexico by Dean E. Winchester. The map shows known oil and gas fields, pipe lines, refineries, and the location of anticlinal structures in the state. It is printed in two colors and sells for $1 on paper and $1.50 on cloth. Copies may be obtained by addressing E. H. Wells, director of the Bureau.

Adams, Neb. Gets Gas Service from Northern Natural

Natural gas was turned on in Adams, Neb., by Mayor John Van Groningen, on October 8, 1931. Northern Natural Gas Co., with headquarters in Omaha, is serving Adams.

Missouri Association Schedules Annual Convention for April 28-30

The next annual convention of the Missouri Association of Public Utilities will be held April 28, 29 and 30, 1932, in Excelsior Springs, Mo.

Asks Newton, Kan., Franchise

Newton Gas Co., Newton, Kan., a Cities Service subsidiary, has applied for a 20-year franchise there, offering a reduction in rates. The company serves natural gas in the town.

Your OPPORTUNITY

DROPPING MERCURY

MEANS RISING PROFITS FROM YOUR HOUSE HEATING LOAD

As November's chill heralds the approach of winter weather, thousands of home owners become gas heating prospects. The year's biggest selling season is at hand. Now is the time to systematically and aggressively follow through on your prospect list.

The Roberts-Gordon Conversion Burner is the best and quickest builder of the house heating load.

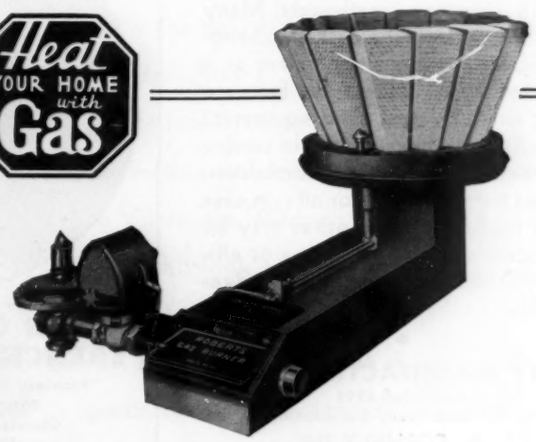
Let us aid in your Fall merchandising campaign. You will find many useful sales and advertising helps in our sales booklet, "Selling the Home Heating Market."

ROBERTS-GORDON
APPLIANCE CORPORATION
CURTISS BLDG. BUFFALO, N. Y.

Trade Mark

ROBERTS
CONTROLLED
GAS HEATING UNIT

Heat YOUR HOME with Gas



LATTNER

Industrial Gas BOILERS

An instantaneous success—

The

H. E. FLUELESS

100 lb.

Lattner Boiler

Available in sizes ¾ to 5 H. P. inclusive. Patented construction with thermal efficiency equal to a tubular boiler. A trouble free boiler for process steam generating.

Also tubular boilers from ½ to 30 H.P. Special alloy tubes.

P. M. LATTNER MANUFACTURING CO.

Factory
516 12th Avenue S. W.
Cedar Rapids, Iowa

Warehouse Distributor
2646 South Hill Street
Los Angeles, California

COMBUSTION EQUIPMENT LEAHY LOS ANGELES CAL. U.S.A.

LUCKY SEVEN

FORTUNES may be won on a lucky number . . but they are saved only through care and forethought. Many older firms, lucky in the past, are changing to Leahy heating equipment as a protection for the future. New firms are turning naturally to Leahy equipment as an assurance of dependable service and economy. Leahy Dual Combustion Furnaces burn either gas or oil . . in case of one fuel failure the other may be substituted without loss of time or efficiency. Replace luck with good judgement. Use Leahy equipment.

◆

LEAHY MANUFACTURING CO
Established 1902
1804-1812 East Eighth Street, Los Angeles, California
E. A. CORNELY INC.
1452 Bush Street, San Francisco, California

THE BABY DIGGER

The Ideal Modern Way To Dig Gas Trench!

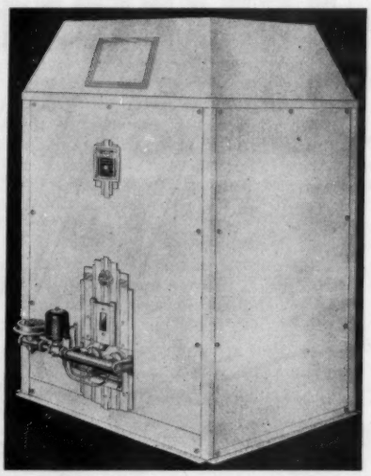
Cleveland Baby Diggers are unequalled for downright usability and trenching satisfaction. Compact — transportable — economical. Tough — fast — dependable. Precision built of finest materials. A wheel type trencher on full crawlers. You'll find Cleveland Trencher pioneering the features that count. Write for particulars.

THE CLEVELAND TRENCHER COMPANY
"Pioneers of the Small Trencher"
20100 St. Clair Ave.
Cleveland, Ohio, U. S. A.
Distributed By
Edward R. Bacon Co., San Francisco, Cal.

New Columbus Furnace by Surface Combustion Corp., Toledo

SURFACE Combustion Corp., Toledo, Ohio, has recently announced production of the new Columbus gas-fired warm air furnace. The new furnace has been redesigned.

The appearance of the unit is in conformity with the present day trends in design. It is automatic, and may be equipped for complete air conditioning if desired with blower unit and filters.



The new Columbus gas-fired warm air heater of the conventional sectional type.

The new Columbus furnace is now the conventional sectional type. Each furnace is designed as a separate unit, with rated heating capacity and heating elements spaced so that air volume and temperature are distributed evenly in the hood areas. One set of controls does the regulation for full automatic operation. For exceptionally large buildings several standard units may be assembled together as one unit with a common hood, in connection with blower additions.

Authorized to Grant Rights to Stockholders and Employees

Peoples Gas Light & Coke Co., has been authorized by the Illinois Commerce Commission to issue 79,000 shares of additional capital stock, 69,000 shares of which will be offered to stockholders and 10,000 shares for employees through the employees savings fund. Shareholders of record December 15 next will be entitled to subscribe for additional shares at $100 per share to 10 per cent of their holdings.

Chas. P. Crowley Affiliates With Pacific Pipe & Supply Co.

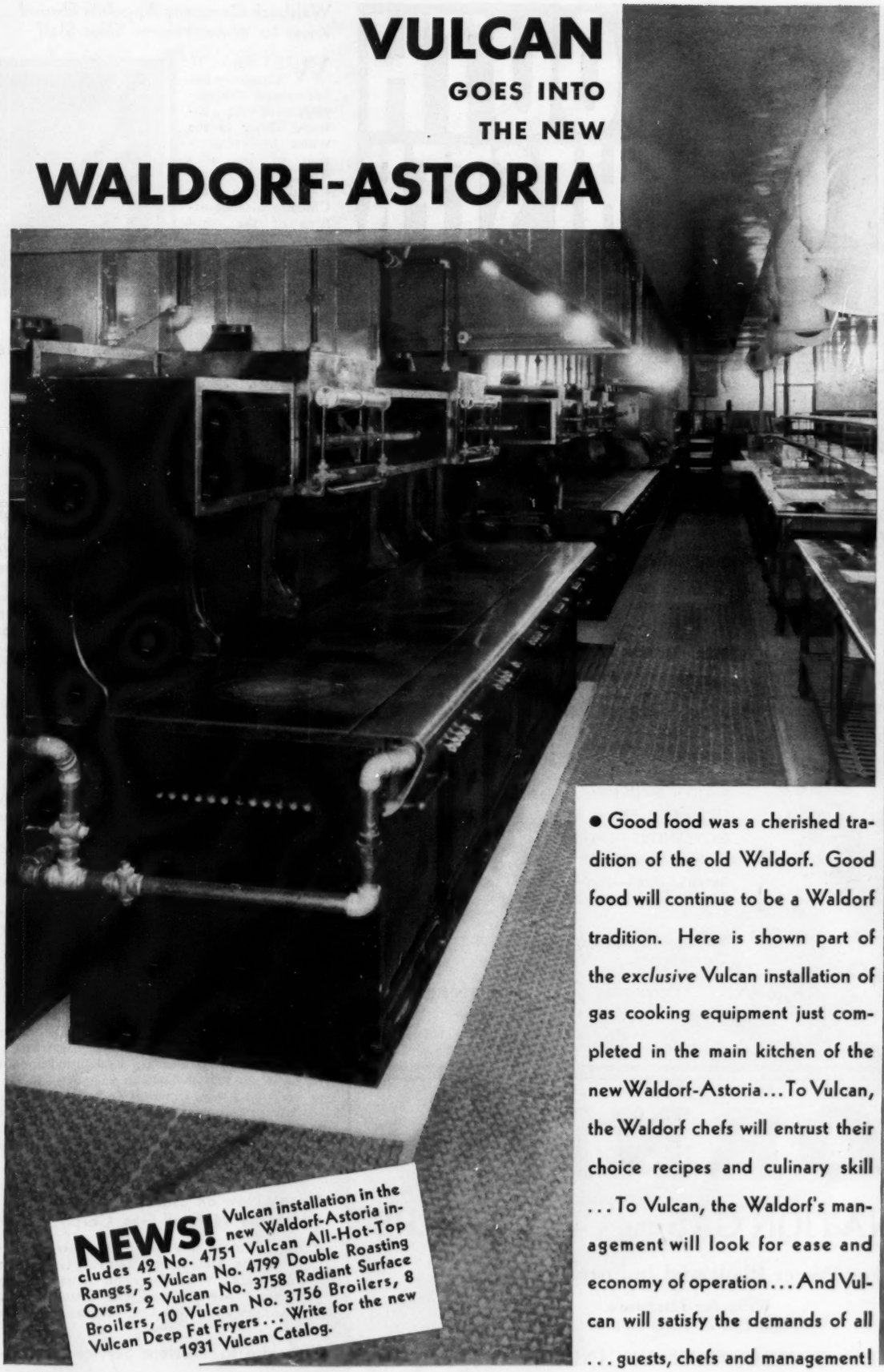
Chas. P. Crowley, formerly associated with the Stone & Webster organization of Boston as desgining and steam engineer, is now connected with the Pacific Pipe & Supply Co. as sales engineer.

Mr. Crowley will have his headquarters at the Los Angeles office of Pacific Pipe & Supply Co., but will cover the entire southern territory in a consulting and sales capacity.

Central Power Co. Applies for Permit

Central Power Co., Grand Island, Neb., has applied for a franchise for permission to serve natural gas in Nebraska City, Neb.

VULCAN
GOES INTO THE NEW
WALDORF-ASTORIA



NEWS! Vulcan installation in the new Waldorf-Astoria includes 42 No. 4751 Vulcan All-Hot-Top Ranges, 5 Vulcan No. 4799 Double Roasting Ovens, 2 Vulcan No. 3758 Radiant Surface Broilers, 10 Vulcan No. 3756 Broilers, 8 Vulcan Deep Fat Fryers... Write for the new 1931 Vulcan Catalog.

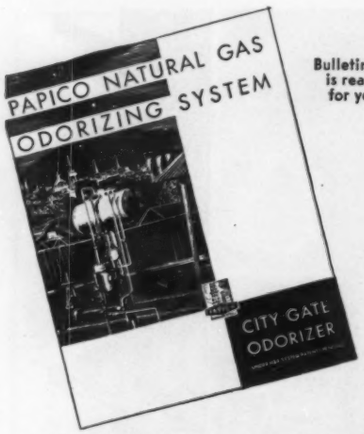
• Good food was a cherished tradition of the old Waldorf. Good food will continue to be a Waldorf tradition. Here is shown part of the *exclusive* Vulcan installation of gas cooking equipment just completed in the main kitchen of the new Waldorf-Astoria... To Vulcan, the Waldorf chefs will entrust their choice recipes and culinary skill ... To Vulcan, the Waldorf's management will look for ease and economy of operation... And Vulcan will satisfy the demands of all ... guests, chefs and management!

VULCAN GAS EQUIPMENT...

HEAVY-DUTY GAS COOKING APPLIANCES FOR EVERY REQUIREMENT OF HOTELS, RESTAURANTS, CLUBS, HOSPITALS, SCHOOLS AND OTHER INSTITUTIONS

STANDARD GAS EQUIPMENT CORP., 18 EAST 41ST STREET, NEW YORK CITY

NEW YORK • BALTIMORE • CHICAGO • BOSTON • BIRMINGHAM • Pacific Coast Distributor: Northwest Gas & Equipment Corp., Portland, Oregon



Bulletin O-4 is ready for you.

SAFETY, ALL THE TIME

This Papico unit guarantees automatic proportional odorization at any desired concentration. Intended for use on lines carrying small flows and a maximum of 75 lbs. w. p., the City Gate unit is smaller than the standard Papico H & K Odorizer, although similar to it in design and sells at a lower price.

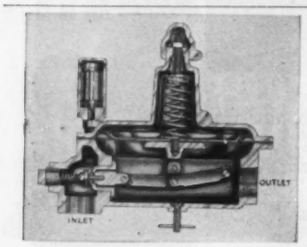
PACIFIC PIPE & SUPPLY CO.
1002 Santa Fe Ave. Los Angeles, Calif.

SOUTH CHESTER STEEL PIPE

Excels for Gas Service

The unusual care given to accuracy of diameter and welding qualities, makes Chester Pipe a favorite for gas lines.

SOUTH CHESTER TUBE CO.
Chester, Pa.



Reynolds Products—

Products for all kinds of Pressure Reduction—for either artifiicial or natural gas.

GOVERNORS—Intermediate Pressure, Triple Outlet, Holder, Toggle Type Street.

REGULATORS—High Pressure Service, Low Pressure Service, High Pressure Line, Single and Double District Station.

VALVE—Automatic, Quick-Closing Anti-Vacuum, Relief, Cut-off.

REYNOLDS

GAS CONTROL SINCE 1892

Reynolds Gas Regulator Co.
Anderson, Indiana
422 Dwight Building—Kansas City, Missouri
Second Unit Santa Fe Building—Dallas, Texas

FORNEY

COMBINATION GAS and OIL BURNERS

For Power Plant and Industrial Uses

Write for Literature and List of Installations

FORNEY COMBUSTION ENGINEERING CO.
513 CENTRAL BANK BUILDING, DALLAS, TEXAS

Welsbach Company Appoints Elwood Roser to Water Heater Sales Staff

Elwood Roser

WELSBACH Company has announced the appointment of Elwood Roser to the water heater division of its sales staff, to be associated with the Chicago district offices of the company.

Mr. Roser at present resides at Atchison, Kansas, and will have as his territory the middle and Southwestern states, in which he has had 16 years of water heater sales experience.

Natural Gas Exploration in British Columbia

Recently the scene of oil and gas exploration in western Canada has been centering in the delta district of the Fraser Valley, near Vancouver, B. C. During the last few months several thousand of acres of natural gas and oil leases have been acquired in that territory extending from Chilliwack to the boundary line. South of the line and in British Columbia, the International Pipe Lines, Ltd., has acquired 100,000 acres for exploration. As close to Vancouver as Lulu Island three wells producing commercial quantities of gas have been reported. International Pipe Lines, Ltd., has extended operations into British Columbia and Abbotsford, three miles north of the boundary.

Peoples Natural Gas Co. In More Franchising Activity

People's Natural Gas Co., Omaha, Neb., has applied for franchises to serve natural gas in Blue Earth, Lake City, Wabasha, and Lake Crystal, Minn., and in October was granted a permit in Cannon Falls, Minn. During September the company was granted gas franchises in 11 cities and towns in southern Minnesota: Emmons, Hartland, Hayfield, Le Suer, Le Suer Center, Belle Plaine, Elysian, New Prague, Farmington, Henderson and Chaska.

P. G. and E. Authorized to Increase Bonded Indebtedness

The California Railroad Commission has authorized the Pacific Gas and Electric Co., San Francisco, to increase its bonded indebtedness from $250,000,000 to $500,000,000, and to execute a supplemental indenture for the increase. The authorization was sought owing to the fact that all but $1,466,300 of the $250,000,000 has been sold or reserved for paying or refunding bonds outstanding.

Storey Now on Staff of Oklahoma Natural Gas Corp.

T. G. Storey has joined the new business staff of the Oklahoma Natural Gas Corp., Tulsa, Okla., as adviser on house heating problems. Mr. Storey was formerly with the Kansas City Gas Co., Kansas City, Mo.

Franchise to Western Service Corp.

Western Service Corp., Oklahoma City, Okla., has been granted a franchise for the service of natural gas at Britton, Okla.

and . . . . . in addition . . . . . The Sani-Speed Top . . . . most important new major development in gas range construction. Perforated lids for speedy heat . . . . a fully enameled top for cleanliness and attractiveness.

The gas range has here been elevated to new standards of beauty . . . . in keeping with the moderne trend in home decoration . . . . Its appeal to the housewife is irresistable.

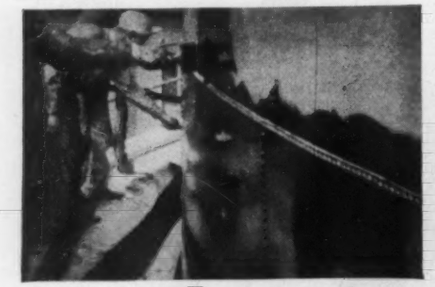
A PRODUCT OF ROPER

TRADE MARK

The Moderne

C. Babcock Co., 135 Bluxome St., San Francisco
Pacific Coast Branch

NEMEC
BURNERS
FOR ALL REQUIREMENTS
NEMEC combustion ENGINEERS
WHITTIER — CALIFORNIA.



Better Protection
for Your Gas Holders

The protection supplied by NO-OX-ID has longer life. It is 100% complete for the entire holder and auxiliary equipment. It is inexpensive—a considerable saving in first cost over materials that have been used in the past.

Write and let us send data, names of users and estimates—proof positive of the long life, economy and 100% effectiveness of NO-OX-ID in this service. Dearborn products are serviced by experienced Dearborn representatives.

Dearborn Chemical Company
LOS ANGELES:
807 Mateo Street Phone TRinity 3385
SAN FRANCISCO:
421 Bryant Street Phone DAvenport 658

NO-OX-ID
IRON-RUST
The Original Rust Preventive

TAPPAN
Supremacy

is not a newly-won achievement, but an old and accepted standing in the eyes of gas appliance men and the public alike. No other gas range combines so many outstanding superiorities into such a perfect whole—the TAPPAN Insulated Oven gas range.

H. R. Basford Co.
665 Howard St.
San Francisco

H. R. Mayer
1001 E. 1st St.
Los Angeles

F. W. Schwab
2512 N. Stevens
Tacoma

New Rate Schedule Filed by Peoples Gas Light and Coke Co.

The Peoples Gas Light and Coke Co., Chicago, Ill., recently filed a new schedule of rates with the Illinois Commerce Commission which will bring about reductions totaling $1,434,000 a year on the basis of the company's present business. The greater part of the cut affects domestic consumers, and applies to the mixed natural and manufactured gas which the company began to distribute on October 16.

New rates went into effect on October 17, the Commission allowing the company to institute them on a temporary basis, subject to readjustment if either company or consumers show them to be inequitable.

Work of adjusting consumers' appliances is still in progress and will not be completed for several weeks.

Following is the former rate schedule:

General Rate

First 2 therms 58c.
Next 24 therms 17c per therm.
Next 239 therms 16.9c per therm.
Over 265 therms 16c per therm.

Optional Rate

Readiness to Serve Charge 5c per day.
Commodity Charge
First 25 therms 15c per therm.
Over 25 therms 14.15c per therm.

House Heating Rate

First 2 therms 58c.
Next 14 therms 17.9c per therm.
Next 16 therms 14.15c per therm.
Over 32 therms 14.15c per therm.

The revised schedule, as originally filed by the company with the Commission, is as follows:

	Per Cent Reduction
General Rate	
First 2 therms 58c	
Next 263 therms 16.4c per therm	3.5
Over 265 therms 15.5c per therm	3.5
Readiness to Serve Charge	
5c per day.	
Commodity Charge	
First 25 therms 14.5c per therm	3.4
Over 25 therms 13.7c per therm	3.4
Demand Charge	
$1.80 per square foot of radiation surface per month for 6 months	22
Commodity Charge	
9.5c per therm	22

Constructing 30-Mile Line to Serve Gas in Eureka, Kan.

Mid-States Pipe Line Co. is constructing a 30-mile, 6-inch line from eastern Elk and Chautauqua Counties in Kansas to Eureka and other towns. The line is expected to be complete by November 1. The company was formed for the purpose of building the line, its market being the Western Gas and Pipe Line Co., subsidiary of Western Power, Light and Telephone Co., with Kansas headquarters at Salina, Kan.

Pacific Lighting Corp. Earnings Increase in 1930-31 Period

Net earnings of Pacific Lighting Corp., San Francisco, amounted to $6,448,658 for 12 months ending August 31, as compared with $6,386,047 for the comparative period a year ago, or an increase of $62,611.

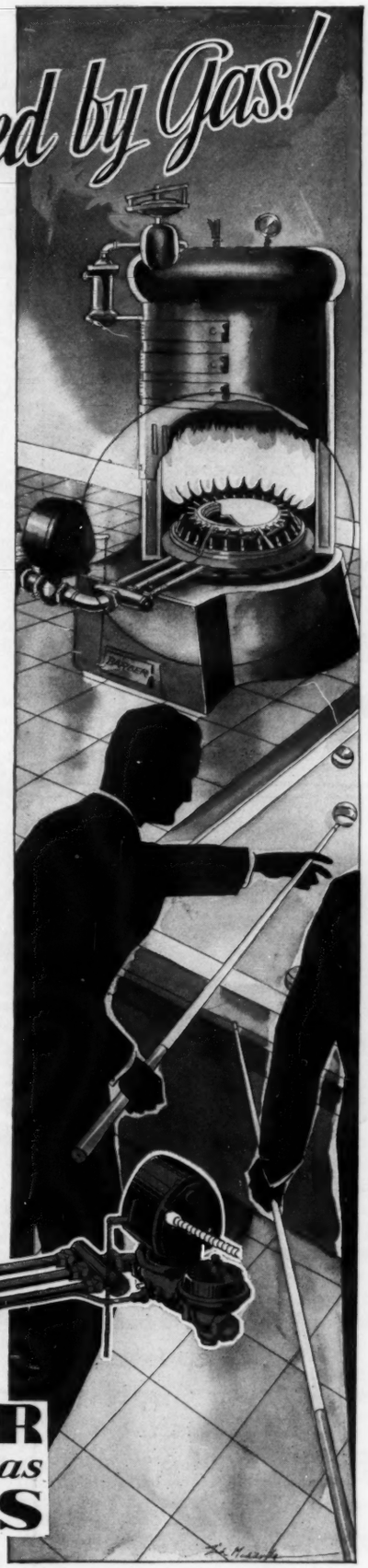
Ellendale Grants Gas Franchise

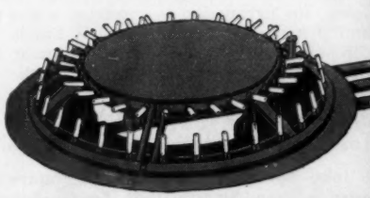
Ellendale, Minn., has granted a natural gas franchise to the Peoples Natural Gas Co., subsidiary of Northern Natural Gas Co., Omaha, Neb.

Transformed by Gas!

Losses *and* Low Profits

Basements are not the only things that Barber Gas Burners transform. They'll transform those low profits and losses into the kind of profits that you want to make. The big swing to AUTOMATIC HEAT is on. Make it pay you!





BARBER
Automatic Jet Gas
BURNERS

THE basement has always been a place of WORK, DIRT and DISORDER to the home owner. Soot, dust, ashes and smoke have occupied it in the winter and left it filthy for the summer.

Not much use trying to keep it clean until Barber Gas Conversion Burners started to take the place of old-fashioned, back-breaking heating methods.

That was over thirteen years ago, and since then tens of thousands of homes have installed economical, carefree GAS HEAT with Barber Gas Burners.

Thousands more will become Barber Gas Burner users this year. Hundreds of them will be right in your community. Are YOU going to make these profits.

No costly replacements of any Furnace or Boiler equipment, and no installation inconvenience with Barber Burners. You can assure your customers of economical and efficient Gas Heating operation for their homes.

Let us tell you how easy it is to demonstrate, sell and install Barber Gas burners. Barber's plan of co-operation with its Dealers is one that insures "tailor-made" installations for every job.

Write today for complete information.

The BARBER GAS BURNER CO.

3702-04 Superior Ave.
Cleveland :: :: :: Ohio

SUBSTANTIAL
REDUCTION
ON VENTED
CLOW GASTEAM
RADIATORS

WRITE for
NEW PRICES

JAMES B. CLOW & SONS
201-299 N. Talman Avenue, Chicago

WORTHINGTON
PRODUCTS

COMPRESSORS
Portable . . . Stationary
ROCK DRILLING EQUIPMENT
Rock Hammers and Drifters
Contractors Air Tools
Drill Steel and Accessories
Automatic Heat Treating Machines
Forging Furnaces
MULTI-V-DRIVES
PUMPS
Centrifugal . . . Steam . . . Power
Rotary . . . Deep Well
FEEDWATER HEATERS
Locomotive . . . Stationary
CONDENSERS
and Auxiliaries
METERS
Water . . . Grease
Oil . . . Gasoline
DIESEL ENGINES
GAS ENGINES
Power and
Compressor Units
CHROMIUM PLATING
Literature on request
WORTHINGTON PUMP AND
MACHINERY CORPORATION
Works: Buffalo. N. Y.; Cincinnati, Ohio;
Harrison, N. J.; Holyoke, Mass.
GENERAL OFFICES: HARRISON, N. J.
District Sales Offices or Representatives
in Principal Cities
WORTHINGTON
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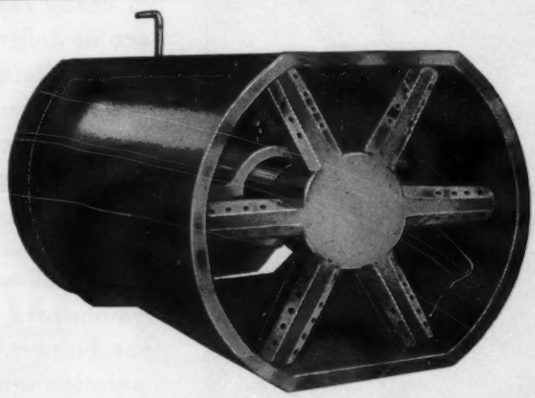
GAS
BURNERS
For
ALL INDUSTRIAL
PURPOSES
JOHN ZINK CO.
Oklahoma Natural Gas Bldg.
Phone 4-9838
TULSA, OKLAHOMA
★
Flameless Burners
Flame Burners
Short Flame Burners



Don't Miss
This Opportunity

Space Heater Radiants
Backwalls
Tunnel Radiants
Leaning Baffles
Radiant Sticks
Burner Tips

to check up on your
refractory costs. Let us send you an estimate on GENCERACO REFRACTORIES and prove that high grade refractories can be obtained at reasonable prices.

GENERAL CERAMICS COMPANY 71 West 35th St., New York, N. Y.

Branch Line to Rochester, Minn. Scheduled for Construction

A branch pipe line from Owatonna, Minn., to Rochester, Minn., will be constructed by the Northern Natural Gas Co., Omaha, Neb., and the gas will probably be distributed in the city by the Interstate Power Co., now serving manufactured gas there. Plans call for the completion of the line sometime in December.

The City of Rochester is reported to be considering the purchase of the Rochester properties of the Interstate Power Co., with a view to operating a municipal distribution system. Interstate Power Co. has proposed a reduction of 20 per cent in gas rates with the advent of natural gas, and an engineer has been named by the mayor of the city to investigate the situation.

Interstate Power distributes manufactured gas in several towns along the route of the Mason City, Iowa, to Owatonna, Minn., line of the Northern Natural System among them Albert Lea, Owatonna, Waseca and New Ulm.

Route of the Rochester extension is given as following old Highway 7, passing south of Claremont between Kasson and Mantorville, and southeast to Rochester. A line will be extended to Claremont if the franchise application now pending there is granted.

New Greaswood Flats Town to Be Served with "Natural"

Eastern Colorado Gas Co. has applied to the state public utilities commission for permission to serve the proposed town of Gearhart with natural gas. The town is to be located in the new Greasewood Flats oil district in Weld county. Gas will be carried to the new community by a 4-inch pipe line from the Reiter-Foster Oil Co.'s well in the field.

Conover General Manager for Oklahoma and Kansas Properties

A. W. Conover, Hominy, Okla., has been appointed general manager of the Oklahoma and Kansas properties of the Empire Public Service Co., the Southwest Pipe Line Co., and the Southwest Production Co., Bristow, Okla. He succeeds B. P. Stockwell, who was recently appointed rate and valuation engineer for Empire Public Service Co.

Blue Earth, Minn., May Have Gas from Central States Electric Co.

An application is now before the City Council of Blue Earth, Minn., from the Central States Electric Co., Cedar Rapids, Iowa, for permission to construct a gas plant and distribution system in Blue Earth. The company owns and operates a plant at Fairmont, Minn., not far from Blue Earth.

J. M. Hendrix is Special West Texas Representative for Community

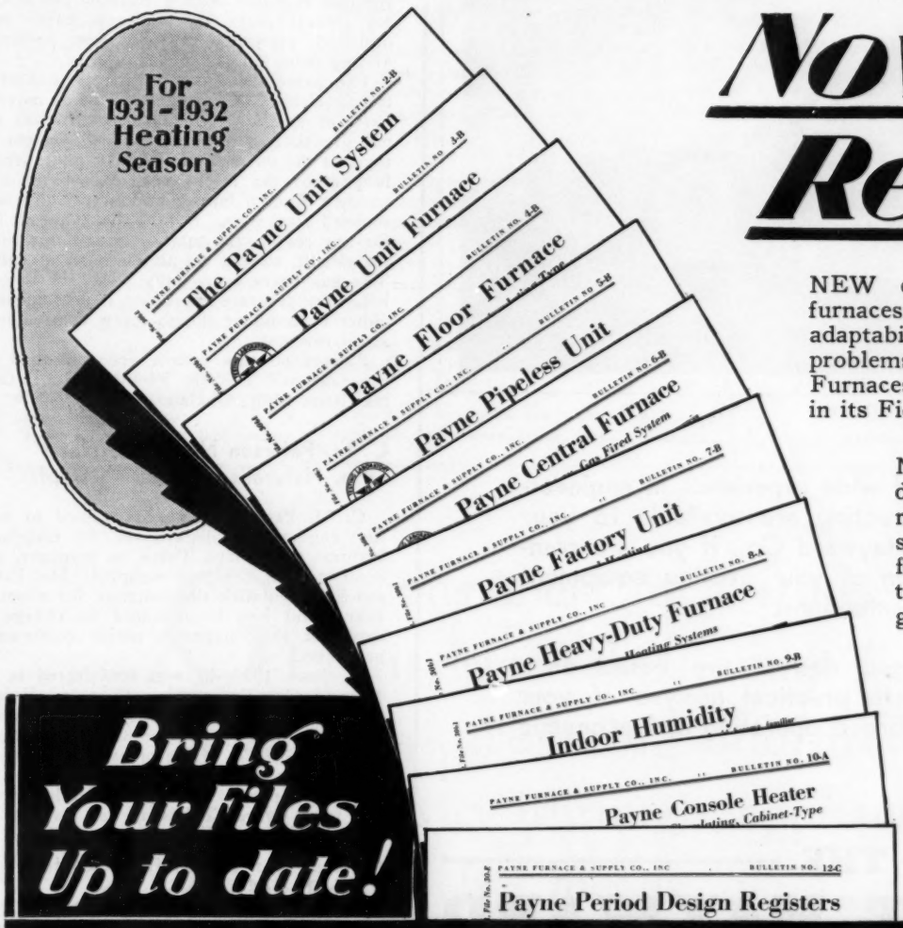
John M. Hendrix, former secretary-manager of the Sweetwater, Texas, board of city development, has been appointed special West Texas representative for the Community Natural Gas Co., Dallas. His headquarters will be in Sweetwater.

Beggs, Okla., to Vote on Franchise

Beggs, Okla., will vote November 10 on granting a gas franchise to David M. Logan of Okmulgee, Okla. The town is now served by the Union Public Service Co.

NEW Literature

Now Ready!



NEW construction features, NEW furnaces, NEW control hookups, NEW adaptability, a wider range of heating problems, makes the Payne line of Gas Furnaces more than ever the Leader in its Field.

NEW catalog bulletins with detailed descriptions, capacity ratings, sizes and valuable installation data are now ready for distribution among architects, contractors, builders and gas company executives.

Typical Plans

A special feature of our new 1931-1932 literature is a series of Typical Heating Plans, illustrating a great variety of Heating Problems which may be solved by our different types of furnaces.

Gas-Fired Circulating Warm Air Systems for All Climates . . .

Here is complete coverage of 95 percent of the entire gas heating field WITH ONE COMPLETE LINE! Why scatter your efforts and energies, wasting valuable time on two or more different makes built for the same purpose, when Payne offers you types and styles for every practical heating need—in every type of building and climate. Backed by 16 years of sales and installation experience, Payne Gas Furnaces are engineered to give the highest possible heating efficiency at the lowest possible installation and operating cost. Recommended and sold by Jobbers, Dealers and Gas Companies throughout the United States and in many foreign countries.

Clip the Coupon

Pin it to your letterhead or other stationery and drop it in the mail to us today.

MAIL TODAY!

Payne

Engineering Service

Payne Factory and Field Engineers gladly submit practical heating plans to solve your difficult heating problems. Write or wire for full particulars . . .

PAYNE FURNACE & SUPPLY CO., Inc.
Beverly Hills, California.

[ ] Send me your Bulletins describing.....

.....

[ ] Send me your complete new catalog.

Name .....

Company .....

Address .....

Nearly 100 years of wide experience in engineering, designing and erecting are available to you, through the Bartlett Hayward Co., if you are planning the re-habilitation of your existing equipment or the installation of extensions.

Recommendations and designs are based on a thorough and complete practical analysis of your requirements from a broad operating and economic viewpoint.

THE
BARTLETT HAYWARD
COMPANY

BALTIMORE — MARYLAND

Coal Gas, Carburetted Water Gas, Blue Water Gas, By-Product Plants—De-Brouwer Charging and Discharging Machines—Waste Heat Boilers—Purifiers—Tar Extractors—Condensers—Feld Scrubbers—Fast's Couplings—Gas Holders.

RAY VITALITE GLO

Radiant Gas Heaters

Send me details about the quick, easy installation feature, and "fixed mix."

Name .....

Company .....

Address .....

Clip and Mail to Ray-Glo Corporation, Athens, Ohio.

New Valve for Controlling Gas Supply to Burners

An electrically controlled valve operating on a new principle has been patented recently by Otto A. Knopp of Oakland, Calif. The patentee has served as a test and inspection engineer with a western gas utility for several years and the new valve was designed primarily to overcome problems arising from the use of natural gas.

The principle of application is that of a thermo-electric valve without coils or moving parts of any kind, and which turns on the gas gradually, preventing sudden accumulations at the burner. The safety pilot, which is part of the mechanism, consists of two parts, a Bunsen burner and a specially constructed steel tube. Should the flame go out for any reason, the tube cools and interrupts the circuit, closing the thermo-electric valve. The gas valve opens only when the tube is hot. Temperature regulation is accomplished either by hand or thumb screw control on a small rheostat.

Patents on this system are controlled by the Gas and Electric Facilities, Ltd., Central Bank Bldg., Oakland, Calif.

C. M. Petersen Named to Head Okla. Natural's Engineering Dept.

C. M. Peterson has been named to head the engineering department of Oklahoma Natural Gas Corp., Tulsa, as manager, succeeding J. B. Compton resigned. Mr. Peterson has been with the company for about 11 years, and has been placed in charge of many of the company's major construction programs.

In June, 1930, he was transferred to the Natural Gas Engineering Corp. as division engineer, supervising much of the engineering work done by that company for Southern Natural Gas Co. He also had charge of all engineering work on the 122-mile line recently completed for Texas Public Service Co. from Girvin Texas, to San Angelo.

Natural Gas Distributing Co. to Serve Red Cloud, Neb., Nov. 15.

Natural Gas Distributing Co., Lincoln, Neb., reports that natural gas will be turned on Nov. 15 at Red Cloud, Neb., supply coming from the Stanolind oil line from Welch, Wyo., to Freeman, Mo., now being reconditioned for gas service. The company also expects to serve Blue Hill, Neb., from this line. Franchise application by the company was favorably acted upon recently by that town.

C. E. Wiser to Represent Northern Natural Gas Co. at Bancroft

C. E. Wiser, engineer for the Council Bluffs Gas Co., Council Bluffs, Iowa, resigned on October 1 to accept a position as superintendent with the Northern Natural Gas Co., and will headquarter in Bancroft, Neb. Arnold Dammrow, member of the sales department at the Council Bluffs Gas Co., succeeds Mr. Wiser.

U. S. Veterans Hospital at Waco to Be on "Natural" Service

The Texas Cities Gas Co. at Waco is beginning work on laying an 8-inch line to the new United States Veteran's Hospital at Waco. Eleven buildings are under construction on the government property. The gas company has ordered about 3 miles of 8-, 6-, and 4-inch wrapped pipe to be used on the job.

The Barrel of Gas

By JAMES H. COLLINS

A dear old Irishman applied for a job at the gas works, saying that he could do anything.

"Can you wheel out a barrel of gas?" asked the foreman.

"Sure! Just fill it up for me!"

◆ ◆ ◆

Once, gas men had to find a way of filling up a barrel of gas—and here is how that was:

The gas pipes were laid under every street in town and into every house, and gas was good, and cheap, and ready to cook chops, boil baby's bottle, and heat a hall or a whole house.

But people had no gas ranges or heaters—no *appliances,* as gas men say.

You can pipe gas into the home, but unless people have appliances, to get the benefit of gas service, you might just as well bring it loose in a barrel.

◆ ◆ ◆

Well, inventors were constantly making better appliances. Gas men were engineers, and tested each new range and heater, and knew which gave the best service, at the lowest expense, with the longest life.

How could this engineering progress be put at the service of the public?

◆ ◆ ◆

At that time — some few years ago — not many storekeepers carried modern gas appliances, because they said, "Our customers never ask for such things."

So the gas men set up shop themselves!

Showrooms were opened, where people could see the latest things, and have them explained by attendants who helped pick out the best appliance for a particular purpose.

Thus, engineering knowledge was linked to the public's need for modern gas service, and before long, enterprising merchants began selling the latest appliances.

They saw that the gas men were doing an educational job, helping the public attain better standards of living. That always creates new customers for the merchant who knows how to follow up.

And so the witty old Irishman wheeled out the barrel of gas!

◆ ◆ ◆ ◆

See the Newest
GAS APPLIANCES
AT YOUR DEALER'S...or

Name and Address of
YOUR GAS COMPANY
in this space

COPYRIGHT 1931
WESTERN BUSINESS PAPERS, INC., L. A.

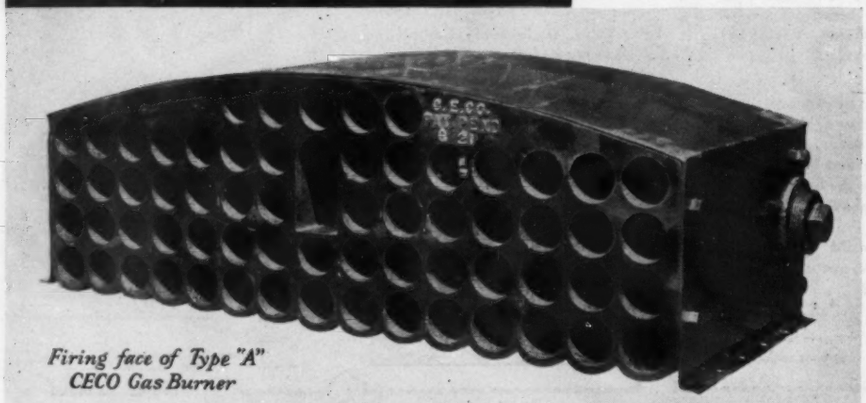
GAS consumers in Arizona, Illinois, Louisiana, Oklahoma, Tennessee and Texas are being informed of gas utility service through appliance merchandising by means of a pamphlet "The Barrel of Gas," the first of a series to be issued by WESTERN GAS.

These pamphlets are available at a price low enough to permit sending one to each of your consumers.

Write for prices. WESTERN GAS, 124 West Fourth Street, Los Angeles, California.

MORE HEAT FOR LESS MONEY

A BULLETIN FULL OF MONEY-SAVING FACTS IS YOURS FOR THE ASKING



Firing face of Type "A" CECO Gas Burner

COMBUSTION EQUIPMENT COMPANY
KANSAS CITY, MO.
WICHITA MEMPHIS HOUSTON

CECO
POWER PLANT TYPE
(A & E SERIES)
MULTIPLE JET GAS BURNERS

BITGOOD
Multiple Jet Gas Burners
Industrial Furnaces
SAN JOAQUIN BURNERS
Prat Daniel Thermix Stacks and Air Heaters
Bigelow-Liptak Suspended Arches and Walls
North American Burners and Blowers
F. S. BITGOOD, Inc.
Furnace and Combustion Engineers
Los Angeles Portland San Francisco

Gentlemen:
Kindly send me a sample can and full details regarding A-B Vit
The New Porcelain Enamel Cleaner
Name.....
Company.....
Address.....
No obligation, of course
Clip and mail today to
A-B STOVE CO., Battle Creek, Mich.

U. S. Bureau of Mines Publishes Report on Motor Fuels from Gas

The United States Department of Commerce, Bureau of Mines, in October brought from the press a report of investigations on the Production of Motor Fuels from Natural Gas, Part I, by H. M. Smith, associate petroleum chemist, Petroleum and Natural Gas Division, U. S. Bureau of Mines; Peter Grandone, assistant petroleum chemist, Helium Division, U. S. Bureau of Mines, and H. T. Rall, assistant petroleum chemist, Petroleum and Natural Gas Division, U. S. Bureau of Mines.

The report deals with the possible outlet for the use of large quantities of natural gas through the manufacture of motor fuels by "pyrogenic synthesis of gaseous, liquid and solid hydrocarbons—a method once considered impractical from the engineering viewpoint, but which today gives some promise of commercial application in the future."

Blesch of S. F. Office of Natural Gas Equip., Inc., On Eastern Trip

Charles A. Blesch, of the San Francisco office of Natural Gas Equipment, Inc., left on October 15 for an extended eastern trip to visit steel mills at Pittsburgh and Chicago and the research laboratory of Surface Combustion Corp. at Toledo, in order to obtain the most recent data on the use and application of Surface Combustion Corp. equipment in the steel industry. Surface Combustion Corp. has recently developed the diffusion type of combustion, of particular application in the use of gas by the steel industry. Mr. Blesch will return to San Francisco December 1, bringing with him detailed information relative to this development.

New Culver City Office Building For Southern Counties Gas Co.

Southern Counties Gas Co., Los Angeles, Calif., is beginning construction of a new office building for its Culver City district, according to J. C. Gilbert, district manager for the company. Included in the features of the new building will be a display floor 30 feet deep and 25 feet wide. The new property adjoins the present office of the company in Culver City.

P. U. A. A. Holds Session Jointly With American Gas Association

A mid-year conference meeting of the Public Utilities Advertising Association was held October 15 at the Traymore Hotel, Atlantic City. The meeting was held in conjunction with the American Gas Association's Annual Convention. The conference began with a luncheon and continued into the afternoon.

Texas Cities Gas Co. Installing Gas in Federal Court Building

Texas Cities Gas Co., Galveston, Texas, has recently secured the contract for converting the boilers in the post office building and the federal court building to natural gas. Coal is now being used in the steam heating plant. Work has already started on the conversion.

Colorado Gas & Utilities Co. Brings in 18,000,000 c. f. Well

Colorado Gas & Utilities Co. of Denver, Colo., completed a gas well in Stevens County, Kan., with an open flow of 18,000,000 cubic feet daily in September. The company owns a natural gas transmission line to points in Southeastern Colorado from the Hugoton field in Stevens County.

ELECTROLUX

is often the deciding factor in saving the cooking load

"Gas refrigeration helps us to prove that gas has a definite place in the modern home!" says Mr. M. A. Boylan, Vice-President in charge of Gas Refrigeration Sales, Scranton Spring Brook Water Co.

HE PROVES THAT GAS HAS A DEFINITE PLACE IN THE MODERN HOME. *Mr. M. A. Boylan, Vice-President of the Scranton Spring Brook Water Co., Scranton, Pa.*

A tiny gas flame takes the place of all moving parts

"WHILE the can-opener may play an important part in the preparation of the 'home-cooked' meal today, the preparation of the family meals still creates a sizable domestic load. Electrolux not only increases that load, but furnishes an additional reason for the original piping of the house with gas. It is this double influence that causes me to believe that the merchandising of gas refrigeration is well worth the attention of gas company officials."

* * *

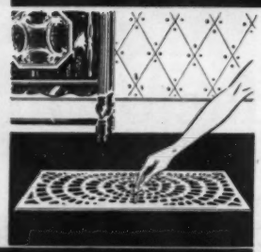
Mr. Boylan's closing remark is a challenge to the gas industry. The selling of gas refrigerators is so closely tied up with the implanting in the public mind of the idea that gas is the modern up-to-date fuel, that any sales effort on refrigerators benefits the industry as a whole. Read between the lines of Mr. Boylan's message and you'll see "What are *you* doing about it?"

Electrolux has made it easy for you to "do something." Carefully worked out plans, catalogues and newspaper announcements are available for the asking. Just write to Electrolux Refrigerator Sales, Inc., Evansville, Indiana.

ELECTROLUX

THE *Gas* REFRIGERATOR

Turn on THE HEAT!



Electrogas
PRODUCES
A NEW MODEL
NUMBER 51
51,000 B.T.U. A.G.A. Approved
"It's Matchless"
ELECTROGAS FURNACE CO.
466 SUTTER STREET • SAN FRANCISCO

New Models!

FRASER CONSOLE
Circulating Heaters

No. 25 25,000 B.t.u.....$49.50
No. 35 35,000 B.t.u.....$59.50
Approved by A.G.A. Testing Laboratory
Write for catalog and prices on these new numbers and on the complete Fraser line.
8 sizes Basement Furnaces
6 Floor and Wall Furnaces
6 sizes Console Heaters
Manufactured by
Fraser Furnace Co.—Stockton, Cal.
Distributed by
H. R. BASFORD CO. San Francisco Los Angeles

VITEX
GAS VENT AND FLUE PIPE
Light – Durable
Insulating
Non-corrosive
PLANT RUBBER and ASBESTOS WORKS
537 Brannan Street · San Francisco
PR-102

WILLIAMS
GAS STEAM RADIATOR
Made in 22 sizes from 26 to 180 feet of rating.
IMMEDIATE HEAT AUTOMATIC LIGHTER
Improved Combustion. Positive Gas Control.
Write for descriptive matter and prices.
WILLIAMS RADIATOR COMPANY
1865-1873 Cordova St. Los Angeles, Calif.

Distribution Plants at Abilene and Cisco Purchased by Community Natural

Purchase of the gas distribution plants at Abilene and Cisco, Texas, from the West Texas Utilities Co. was announced by the Community Natural Gas Co. on October 16. Abilene has 6,700 consumers and Cisco over 1,500. Both cities have been supplied with gas wholesale by the Lone Star Gas Co. for several years.

Abilene headquarters have one of the largest display rooms on the Community Natural Gas system with the complete line of modern gas appliances displayed on the ground floor of the Masonic Temple.

C. C. Redding, formerly manager for the Community Natural at Bryan, has been appointed manager of the Abilene property and H. L. Dyer will be in charge at Cisco. M. E. Adams, formerly storekeeper at Mexia for the company, will replace Mr. Redding at Bryan.

Mr. Redding entered the gas industry in 1926 at Honey Grove, Texas, where he was engaged in constructing the town plant. Later he was transferred to the main line inspection department of the Lone Star Gas Co. and from this position was sent to Mart as local agent for the Community Natural, where he remained until 1928, when he was made district manager of the Bryan district.

Mr. Dyer was employed by the Community Natural in 1930, being stationed in the new business department at Bonham, Texas. He was transferred to the Stargas department and later changed to the home service department, where he remained until his present appointment as manager at Cisco.

Mr. Adams has been with the Community Natural since 1926, when he was engaged on pipe line construction work. In January, 1929, he was sent to take charge of the Mexia storehouse and remained there until his transfer to Bryan.

New Rate Schedule for San Antonio Public Service

New gas rates will become effective November 1 in San Antonio Texas, according to an announcement made by the San Antonio Public Service Co. The new schedule is as follows:

First 2000 cubic feet, 78.5 cents; next 18,000 cubic feet, 76.5 cents; next 10,000 cubic feet, 67.5 cents; next 20,000, 58.5 cents, and all over 20,000 cubic feet 50 cents.

This amounts to a 12½ per cent reduction for the first 2,000 cubic feet of gas. Customers using from 30 to 50,000 will have a reduction amounting to approximately 13.3 per cent and consumers in the 50 to 100,000 block will receive a 26 per cent reduction.

New Line to Augment Supply to Liberty, Mo., from Smithville Field

Construction of a new gas transmission line from fields near Smithville, Mo., to Liberty, was begun the first of October by the Liberty Gas & Service Co. of Liberty. Contract for the line has been awarded to Brown-Straus Corp. of Kansas City. The carrier is about 12 miles long and will augment the present supply for the town, which comes from the Avondale district.

C. A. Prophit to Manage the Natural Gas Co. of Monroe, La.

C. A. Prophit has been named manager of the Natural Gas Co., Monroe, La., filling the position left vacant by the death of C. L. Melebeck. Mr. Prophit was formerly director of public relations for the company.

TIE-IN ADVERTISING "Rings the Bell"

PROGRESSIVE dealers have long since discovered that, instead of featuring any particular line of gas appliances, P. G. and E. newspaper advertising is designed to create public acceptance of ALL gas appliances of good quality. In addition, each advertisement suggests that its readers . . . . your prospects . . . . visit their dealers' stores.

In view of these facts, many dealers have increased their sales by tying in their advertising with that of this Company. The miniature reproduction of a newspaper page shown here exemplifies this cooperative spirit.

Jane Friendly Outlines New Lounge Events
Text of President's Plea for Jobless Relief
"They're not coming! ...it must be this drafty house
We'll have to install Natural Gas heating"
INSTALL AN ATLAS NATURAL GAS FURNACE
Heat Your Home for Less
Atlas Heating & Ventilating Co., Ltd.
heat FROM Natural Gas with The New Improved MARS GAS FURNACE Real Heating Comfort at Low Cost
VAPEX
PACIFIC GAS AND ELECTRIC COMPANY
P·G·and E·
FRASER NATURAL GAS HEATING EQUIPMENT
RUUD HEATER CO.

Notice how other dealers tie in their advertising with that of this Company.

Should you desire to increase your sales, as others are doing, it will be worth your while to try the following easy "formula":

First: Call your local newspaper offices each week. Ask each publisher WHEN a P. G. and E. gas appliance advertisement is to be published.

Second: Plan an advertisement of your own . . . telling prospects WHERE you are located and WHAT particular line of appliances you have to offer.

Third: Ask your local newspaper to publish your advertisement in space adjoining ours.

RESULT: Prospects created by P. G. and E. advertising will know WHICH dealer to see, WHERE he is located and WHAT appliances he carries.

PACIFIC GAS AND ELECTRIC COMPANY

P·G·and E·

Owned · Operated · Managed
by Californians

286-1131 WG

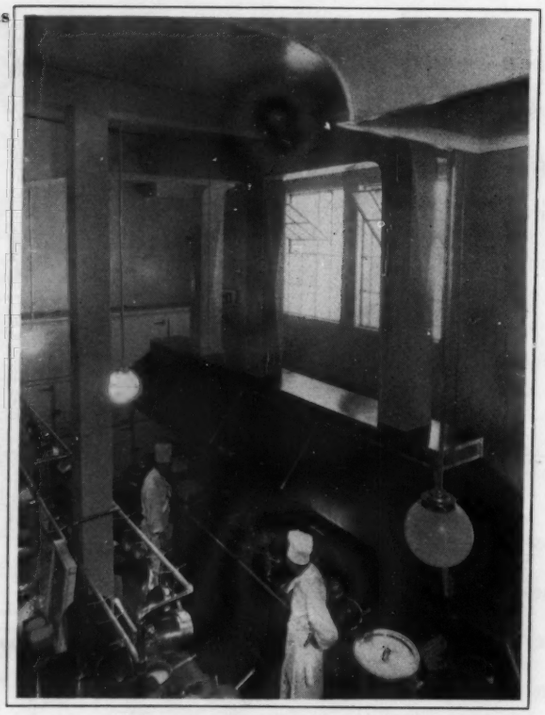
"Perfectly Satisfied."

" . . . if I were opening another restaurant tomorrow I would buy MADSEN RANGES"

. . . "Bob" Cobb

H. K. SOMBORN has recently opened his fourth Brown Derby, in Beverly Hills, and again he has equipped his kitchens with Madsen Ranges. Says "Bob" Cobb, popular and efficient Brown Derby manager, "Madsen Ranges have given perfect satisfaction; they are economical and well built. If I were opening another restaurant tomorrow, I would specify Madsen Ranges."

The Brown Derbies, in Hollywood, in the smart Wilshire section, in fashionable Beverly Hills, are suffering from no depression. As Herbert Somborn says, there is always a market for fine food, properly served. Successful places such as these are splendid customers for gas. They deserve the best in gas-consuming appliances. Why not help your customers to learn all the facts about the superiority of Madsen gas-fired equipment? We will gladly cooperate.

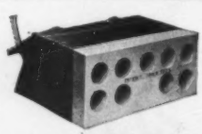
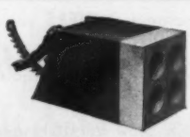


Madsen Ranges in Brown Derby No. 3

MADSEN HOTEL AND RESTAURANT KITCHEN EQUIPMENT SOLD BY LEADING EQUIPMENT DEALERS

MADSEN IRON WORKS, LTD.

P. O. Box 601, Huntington Park, California
(Suburb of Los Angeles)
San Francisco Factory Representative
Fred R. Sanford, 631 Second Street

Mettler Entrained Combustion Gas Burners

FOR ALL Purposes
Kinds of gas
Pressures

406 S. Main St. LEE B. METTLER. CO. Los Angeles Cal.

Fort Crockett, Texas, on "Natural" After 17 Years Negotiation

After 17 years negotiation, the Texas Cities Gas Co. is now supplying the Fort Crockett Military Reservation at Galveston, Tex., with natural gas. An estimate of 21,000,000 cubic feet is added to the company's load.

Initial effort to secure this business was made in 1914, but it was not until this year that the proposal to serve the fort with gas was actually put into effect, at a saving of about $4,000 a year for the Government.

One of the hurdles was the question of whether all fuel users at the fort could use gas and stay within their fuel allowance, which in gas would amount to 40, 60 or 80 per cent as many B.t.u.'s as were called for in the coal allotment. In order to convince army officials of the efficiency of gas, it was necessary for the company to extend mains into the reservation and make demonstration range and water heating installations. Through this demonstration gas proved itself the most satisfactory fuel for the Post.

Equipment now in use at the fort includes the following: 107 circulators, 126 space heaters, 45 water heaters, 33 ranges, 11 heavy duty hotel ranges, 9 conversion burners and one house heating boiler.

Open Branch Office of Gas and Electric Appliance Co.

F. R. McNabb, representing the Gas and Electric Appliance Co., has opened a branch office at Ulysses, Kan. Mr. McNabb will be assisted by Jack Finch. The company will retail ranges, burners, and other gas appliances.

Johnson, Kan., has also recently been added to the company's territory, headquarters being maintained at Abilene.

Central States Electric Co. Wants to Build Line to Knoxville

Hearing is set for November 3 before the state utilities commission on the Central States Electric Co.'s petition for permission to build a natural gas lateral from Continental Construction Corp.'s main line to Knoxville, Iowa. The company headquarters at Cedar Rapids.

Braman Oil Co. Completes New Line to Choteau and Pryor

The Choteau Gas Co. has received bids for replacing defective lines in its natural gas system at Choteau, Okla. The Braman Oil Co. has recently completed a new transmission line which will bring an additional supply of natural gas to Choteau and Pryor.

Ask to Serve Big Lake from Texas Public Service Co.'s Line

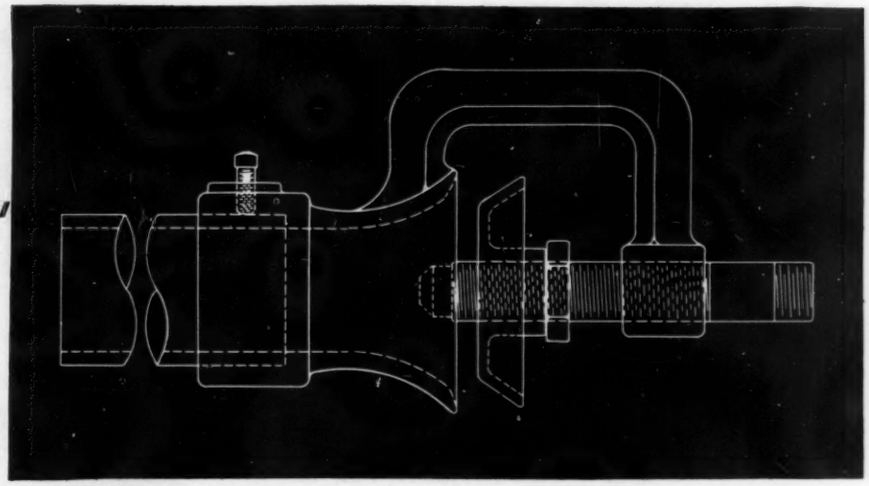
J. P. Kittrell and associates have filed an application for permission to build a gas distribution system at Big Lake, Texas, getting their supply from the Texas Public Service Co.'s line. Mr. Kittrell proposes to spend about $30,000 in the development.

The Borden Co. Offers New Catalog on Beaver Line

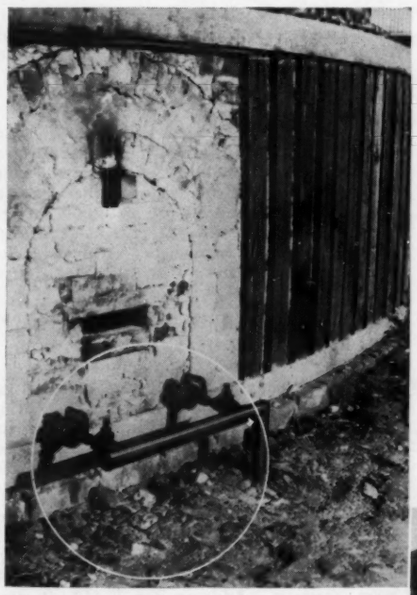
The Borden Co., Warren, Ohio, manufacturer of the Beaver line of pipe tools, has published a new condensed catalog No. 32. Nine tools have been added to the line since the previous edition of the catalog. Copies may be had by addressing the company.

Look to the Pioneers
for
Continued Leadership

TYPE "K"



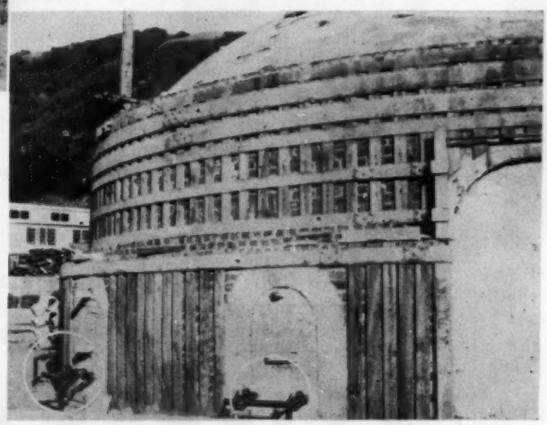
An improved N.G.E. GAS BURNER for CERAMIC KILNS



In keeping with the progress of the Ceramic Industry, N. G. E. engineers have produced a special type of gas burner for kiln service. It applies the correct combustion and provides a greater uniformity of heat. In firing common brick with oil or coal only 80% or 90% grade A brick are expected, due to distortion caused by the flames. With the new N. G. E. Type "K" Burners the culls or seconds are reduced to 5% or less. These Burners are also readily adaptable to flashing, for producing various shades in brick and for firing on colored ware without discoloration.

Applications of N. G. E. Kiln Burners

1. Scove or field kilns.
2. Up-draft kilns, permanent walls.
3. Down-draft kilns, beehive or rectangular.
4. Continuous chamber kilns.
5. Tunnel kilns.
6. Rotary kilns.
7. Rotary dryers.



Bulletin describing Type "K" Kiln Burner, upon request.

Advantages

Correctly designed Venturi automatically controls amount of primary air.

No constriction of air passage.

Brass spud, precision drilled, makes uniform capacity.

Spud accurately aligned with axis of mixer, assuring highest efficiency.

No refractories to burn out.

Interchangeable with present oil installations.

NATURAL GAS EQUIPMENT, INC.

LOS ANGELES, Petroleum Securities Bldg. SAN FRANCISCO, 1123 Harrison Street

Pacific Coast Distributors for Webster Engineering Co., Tulsa; Surface Combustion Co., Toledo

Montana Distributors: Heating Assurance, Inc., Butte, Mont.

FOR ALL TYPES OF GASES USE

LAVA

AT THE POINT OF COMBUSTION

Pilot Tips
and Burner Heads

Innumerable Styles Are Being Made by Us for Gas Appliance, Oil Burner and Industrial Equipment Manufacturers.

Industrial Lava Gas Tips for Pipe Burners

FOR ARTIFICIAL U.S. Pat. No. 1990644 TYPE-C

Specify ALCO Type-N Tips, in four sizes, for Natural, Butane and other high B.t.u. gases.

ALCO Type-C Tips have been designed for use with artificial gas and are available for use with this fuel in various standard sizes or any special sizes.

FOR NATURAL U.S. Pat. No. 1769881 TYPE-N

Have You Our New Gas Booklet No. 31?

Lava is non-corrosive and non-carbonizing

AMERICAN LAVA CORPORATION

25-29 William St. **Chattanooga, Tennessee**

Visit Our Display at Atlantic City Next Month.

For smart living... this exclusive apartment hotel in the heart of the famous Wilshire District, overlooking beautiful Westlake and Lafayette Parks.

Rates on Application

L. C. Reed, Manager

The Arcady
2619 WILSHIRE BLVD.
LOS ANGELES

MUELLER
GAS ERA
BOILERS

fill the most exacting demands for thoroughly dependable and economical gas-fired steam and hot water heating equipment.

For details, write:

L. J. MUELLER FURNACE CO.,
334 S. 2nd St., Milwaukee, Wis.

Makers of a complete line of gas-fired boilers and pressed steel and cast furnaces

Classified Advertising

Classified advertising five cents per word; minimum $2.00 per insertion. Situation Wanted advertisements up to 50 words will be published three consecutive issues without charge. Small professional cards 1-in. deep by 21 ems wide are $5.00 monthly on 12-time contract.

SITUATIONS WANTED—MALE

Mechanical engineer and draftsman experienced in laying out, drawing plans, and writing construction specifications for gas compressor stations and natural gas absorption plants, also supervision of construction; desires position with company needing qualified man. Applicant's age, 29 years. References and record of experience will be supplied. Available December 1 or before with about one week's notice. Address Box E-161, *Western Gas,* 124 West Fourth St., Los Angeles, Calif.

Manager, aged 34, married, with 10 years experience in public utility operation, desires connection with possibility of future advancement. Capable of managing either natural gas or electric property up to 5,000 meters. Location immaterial. Detailed experience and references furnished. Address, Box E-155, care of *Western Gas,* 124 West Fourth Street, Los Angeles.

Position wanted as local manager for a natural gas utility. Applicant has had 6 years experience as manager for large gas companies in Texas and Missouri. Will go anywhere. Can also handle merchandising work. Address Box E-157, *Western Gas,* 124 West Fourth Street, Los Angeles, Calif.

Position desired as franchising agent. Applicant has had successful experience in obtaining utility franchises. Will go any where but is particularly interested in southwest territory. Address Box E-159, *Western Gas,* 124 West Fourth Street, Los Angeles, Calif.

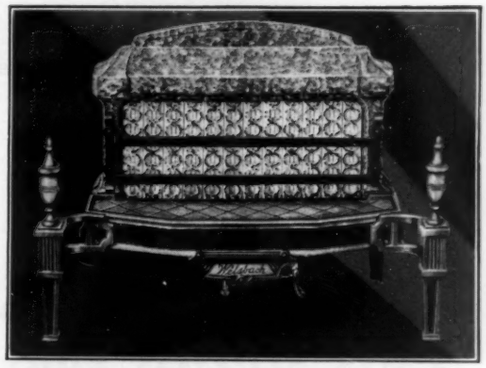
Council Grove Service Scheduled to Start About November 1

Home Gas Co. will begin serving Council Grove, Kan., about November 1, through a high pressure system. Supply for the town will come from the Loomis gas field, S. P. Loomis having been granted a franchise in Council Grove last July. Larry Rumold has been placed in charge of the Council Grove office for the company.

To Serve Fire Brick Co. From Panhandle Eastern Line

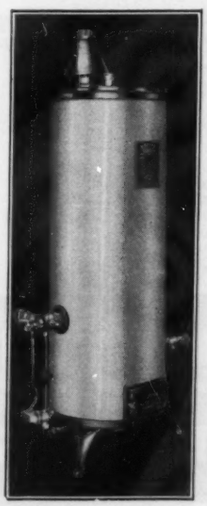
Missouri Power & Light Co., Kansas City, Mo., has been given permission to construct a line from the main carrier of the Panhandle Eastern Pipe Line Co. to the manufacturing plants of the A. P. Green Fire Brick Co., near Mexico, Mo.

Time proved value is of Key Importance in these days of Careful Buying



THESE are days of careful buying. Close scrutiny of value is the rule . . . And the name Welsbach, backed by 40 years of earned leadership in the gas appliance field, is recognized by Commercial Managers more fully than ever before as a definite factor in making sales... **Welsbach Radiant Heaters** are outstanding because of their original design and fine finish—yet are moderately priced . . . Welsbach quality is revealed in every detail of their construction.

Welsbach Water Heaters have gained their leadership through their efficient performance (and favorable prices). In fact there is not a single detail of any Welsbach appliance that will not bear close examination by today's buyers. When Welsbach gas appliances are featured, profitable sales are sure to result.



Member of American Gas Association

WELSBACH COMPANY

GLOUCESTER CITY, N. J.

Offices in Principal Cities

50 Hawthorne Street, San Francisco
226 South Wabash Avenue, Chicago, Ill.

SPRAGUE SEMI-CHROME LEATHER

Resists acids
and boiling water.

Now Used in All

SPRAGUE METERS AND REGULATORS

May we send you
samples and data?

The Sprague Meter Co.

BRIDGEPORT, CONN.
Los Angeles, Calif., San Francisco, Calif.
Newark, Ohio
Davenport, Iowa Houston, Texas

NEARLY 13,500 NOW IN USE

PATENTED

UNMEASURED FLOW PAYS NO DIVIDENDS » » » »

It's mighty easy for a worn or damaged orifice disc to let a portion of the flow pass by without being measured. Ease of disc inspection in a ROBINSON ORIFICE FITTING eliminates faulty orifice plates and metering accuracy is held at a maximum. Other valuable attributes of this most modern orifice fitting are: Ease of installation with lowest costs, elimination of all by-pass piping and fittings, flow unhampered while disc is being removed and occupies least space. Our latest Catalog fully describes the ROBINSON ORIFICE FITTING and shows many interesting installations; a copy will be sent upon request.

Robinson Orifice Fitting Company
1435 Santa Fe Ave. Los Angeles, California, U. S. A.

Distributors:

The Foxboro Company—Foxboro, Mass.
Chicago, Dallas, Houston,
Los Angeles, Pittsburgh, Tulsa

Westcott & Greis, Inc.
Dallas, Houston, Los Angeles, Tulsa

English Distributor:
Walker, Crosweller & Company
54-58 Queen Elizabeth Street
London, S.E. No. 1

Canadian Distributors:
Peacock Brothers, Limited
Montreal-Calgary-Winnipeg

ROBINSON ORIFICE FITTINGS

Make Sure it's a

WEDGEWOOD

GAS CONSOLE CIRCULATOR

Look to the Wedgewood for all that should be demanded in a Gas Console Circulator.

Economy in operation.

Efficiency in performance.

Full porcelain finish—will not stain or discolor.

Extra heavy steel drum acetylene welded to prevent leaks.

The cleanest, quickest heat obtainable.

Beautiful two-tone walnut porcelain console cabinet.

The visible flame gives out a pleasant glow and radiates a flow of wide-spreading warmth. . . . Lights automatically with gas pilot. . . . Can be vented in fireplace easily and quickly. . . . Heats several rooms comfortably at low cost. . . . Make sure of the utmost value and permanent satisfaction by selecting the Wedgewood Gas Console Circulator.

JAMES GRAHAM MFG. CO.

Largest Stove Manufacturers in the West

A Pioneer That Is Still the Leader

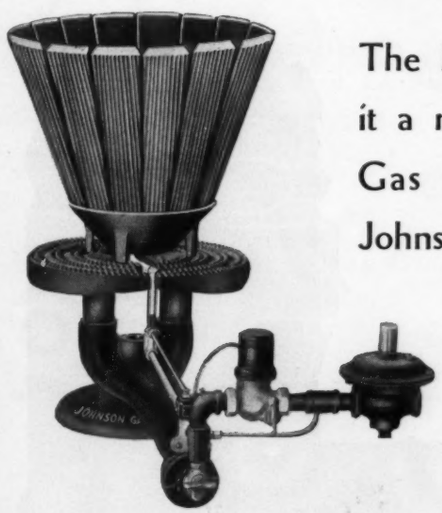
San Francisco, Newark, Calif., Los Angeles

Two Sizes

No. 25 and No. 35

JOHNSON JUNIOR

The Popular-Priced Burner That Has Clicked!



The built-in quality of the Johnson Junior has made it a most sensational favorite in the popular price field. Gas Home Heating has been generally accepted. Johnson Junior, by eliminating the "high cast barrier" has paved the way for a clean sweep. Get complete details on this burner today.

JOHNSON GAS APPLIANCE CO.

Cedar Rapids IOWA

Pacific Coast Representative—C. B. BABCOCK CO.

135 Bluxome St., San Francisco, Calif.

When your customer demands "plenty of heat"—

SPARK

HEAVY DUTY GAS HEATER

A new model with B.T.U. rating of 45,000

(Patents Pending)
No. 604-M

Both in appearance and in performance the new No. 604-M is the greatest advancement yet made in gas circulating heaters of the large-capacity type. It has the same beautiful enamel finish that has made our smaller heaters so popular, but its B.T.U. rating is 45,000. The A.G.A. approval is convincing proof of its efficiency. Provides quick, radiant heat as well as circulating warmth. An important addition to your line. Retails for $78.50.

MANUFACTURED BY
Hammer-Bray Co.
Oakland California

SAN FRANCISCO
180 New Montgomery St.

LOS ANGELES
7000 Avalon Boulevard

PORTLAND
330 Union Avenue, North

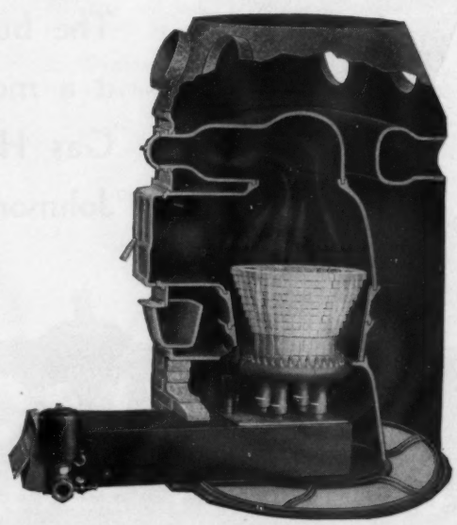
SEATTLE
1016 First Avenue, South

Improved

SAFETY PILOT

as used in the Maxon Automatic Gas Burner has no adjustments, and though slightly less sensitive is absolutely sure in its action. The bi-metal element is shielded from the heat and all wiring is insulated by asbestos covering and encased in the tube which supplies air for the pilot.

The pilot line contains twin limiting orifices which prevent the pilot flame from becoming extinguished by sudden surges in the gas line.



This is No. 2 of a series of ads describing the distinctive features of this quality burner.

MAXON PREMIX BURNER COMPANY
MUNCIE, INDIANA

DIRECTORY

Byllesby Engineering and Management Corporation

Wholly-owned subsidiary of Standard Gas and Electric Company

231 South La Salle Street, Chicago
New York Pittsburgh San Francisco

GAS PIPE LINE MAP

Compiled by the Editors of WESTERN GAS—Size 45" x 45"

The most comprehensive published; covers the 22 western states in detail. Gives gas fields, names of natural gas communities; sizes of pipe lines and names of pipe line companies

Prices, $1.50, Heavy Bond Paper; $3.50, Printed on Cloth

WESTERN GAS

124 West Fourth St. Los Angeles, Calif.

If you would keep in touch with the Natural Gas and Butane industries, send a check for $2.00 to

WESTERN GAS
124 West Fourth Street, Los Angeles

Name.....

Company.....

Position Occupied.....

Street Address.....

City and State.....

Subscription Rates: 1 Year $2.00; 3 years $5.00; Foreign $3.00 per year

Your Unaccounted for Gas Problem Is Our Best Sales Argument for DOUBLEX SIMPLEX CAST IRON PIPE

(Left) Unaccounted-for gas loss will never trouble this western gas company which is installing 12 and 16-inch Doublex Simplex Cast Iron Pipe in its urban lines. It's costly enough to have to tear up pavement to make the initial installation; therefore Doublex Simplex Cast Iron Pipe is being installed to prevent repetition of this expense.

TIME and again you find us stressing certain facts about Doublex Simplex Cast Iron Pipe . . . its extraordinary resistance to destruction by corrosion . . . its strength properties, with consequent ability to carry high gas pressures; and the Doublex Simplex Joint . . . its ability to carry high gas pressures while allowing maximum deflection and longitudinal expansion and contraction without leaking . . . its simplicity, with resultant laying economies . . . its long leakproof life, due to certain inherent gasket-compression characteristics. But the all-important feature of Doublex Simplex Cast Iron Pipe is that it banishes forever the bogie of unaccounted-for gas loss so far as the future is concerned. Write nearest Acipco office for your copy of our catalog "Doublex Simplex Cast Iron Pipe" and for details, quotations, etc., on your next job.

THIS LITTLE "SEAT" DOES A BIG JOB!

Rubber under compression retains its "life." Design of the Doublex Simplex Joint includes a positive "seat" which acts to confine the gasket, reducing "flow" of the rubber and resulting in maximum compression area—which is used to grip the surfaces of the pipe and make a bottle-tight joint while the large cross-section of the gasket allows for ample deflection and longitudinal expansion and contraction in the line.

AMERICAN CAST IRON PIPE CO.
BIRMINGHAM, ALABAMA

SAN FRANCISCO DALLAS NEW YORK CITY
CHICAGO MINNEAPOLIS SEATTLE
KANSAS CITY LOS ANGELES CLEVELAND

1131 G

Advertisers' Index

The A-B Stove Co. ... 76
Alco Valve Co. ... 56
The Alpha-Lux Co., Inc. ... 64
American Cast Iron Pipe Co. ... 87
American Gas Products Corpn. ... —
American Lava Corporation ... 82
American Meter Company ... 7-9
The Arcady ... 82

The Barber Gas Burner Co. ... 71
Barber-Greene Company ... —
The Bartlett Hayward Co. ... 74
H. R. Basford Company ... 78
The Bastian-Blessing Co. ... 52
Biggs Boiler Works Co. ... 53
F. S. Bitgood, Inc. ... 76
Brokaw, Dixon, Garner & McKee Engineering Co., Inc. ... 51

The Cast Iron Pipe Research Ass'n. ... 8
The Chaplin-Fulton Mfg. Co. ... 64
The Cleveland Trencher Co. ... 66
James B. Clow & Sons ... 72
Combustion Equipment Co. ... 76
Connelly Iron Sponge & Gov. Co. ... 53
The Cooper-Bessemer Company ... *Back Cover*

Dearborn Chemical Co. ... 70
S. R. Dresser Mfg. Company ... 12

Electrogas Furnace Company ... 78
Electrolux Refrigerator Sales, Inc. ... 77

The Fisher Governor Co. ... 4
The Fluor Corporation, Ltd. ... 1
Forney Combustion Engr. Co. ... 68
Foxboro Company ... 14
Fraser Furnace Co. Inc. ... 78

General Ceramics Co. ... 72
General Gas Light Company ... 57
James Graham Mfg. Co. ... 85
Groble Gas Regulator Company ... 51

Hammer-Bray Co. ... 86
Hydrauger Corporation, Ltd. ... 11

Johnson Gas Appliance Co. ... 85

The C. M. Kemp Mfg. Co. ... 50

P. M. Lattner Mfg. Co. ... 66
Leahy Mfg. Company ... 66

Madsen Iron Works ... 80
Maxon-Premix Burner Co. ... 86
Bruce McDonald Co. ... —
Merco Nordstrom Valve Co. ... *Front Cover*
Lee B. Mettler Co. ... 80
Milwaukee Gas Specialty Co. ... —
Minneapolis-Honeywell Regulator Co. ... 61
L. J. Mueller Furnace Company ... 82

National Transit Pump & Machine Co. ... 10
The National Tube Co. ... 55
Natural Gas Equipment, Inc. ... 81
Natural Gas Properties, Inc. ... 49
Naylor Pipe Company ... 2
Nemec Combustion Engineers ... 70
Newman Gas Equipment Co. ... 56

Pacific Gas & Electric Company ... 79
Pacific Gas Radiator Company ... 59
Pacific Pipe & Supply Co. ... 68
Pacific States Cast Iron Pipe Co. ... 50
Parsons Engineering Co. ... 50
Payne Furnace & Supply Co., Inc. ... 73
Pittsburgh Equitable Meter Co. ... *Second Cover*
Plant Rubber & Asbestos Works ... 78

Ray-Glo Corporation ... 74
Reliance Mfg. Company ... —
Reynolds Gas Regulator Company ... 68
Roberts-Gordon Appliance Corp. ... 65
Robertshaw Thermostat Company ... 63
Robinson Orifice Fitting Company ... 84
George D. Roper Corp. ... 69

Safety Gas Main Stopper Company ... 62
Wm. B. Scaife & Sons Co. ... 49
South Chester Tube Co. ... 68
Sprague Meter Co. ... 84
Standard Gas Equipment Corp. ... 67
Standard Oil Company of California ... 53
Surface Combustion Co. ... 47

Tappan Stove Company ... 70

United States Pipe & Foundry Co. ... 5

Wailes Dove-Hermiston Corp. ... *3rd Cover*
Walworth Company ... 3
Welsbach Co. ... 83
Western Gas ... 6-75
Westcott & Greis, Inc. ... —
The Wilcolator Company ... 70
Williams Radiator Co. ... 78
Worthington Pump & Machine Corp. ... 72

The Youngstown Sheet & Tube Co. ... —

John Zink Co. ... 72

There are Two Sides to a Price Tag

When the builders of the Inter-State, Empire, Denver, Memphis, St. Louis, Panhandle-Eastern and most of the other big oil and gas lines selected Bitumastic Enamel, they knew it would add to the cost of the line as compared with cheaper forms of protection.

But they also felt that their lines would be in good condition long after less adequately protected pipe had begun to show unmistakable depreciation. They knew that depending on soil conditions, the small difference in first cost might mean the difference between good condition and heavy depreciation in a few years of service.

They knew, in short, that there are two sides to pipe protection price tags and that only one side is shown by manufacturers who bank on price to book an order.

Seeing BOTH sides of the question has led to the specification of Bitumastic Enamel, wholly or in part, for MOST of the big oil and gas lines laid in the United States.

BITUMASTIC
REG. U.S. PAT. OFF
ENAMEL

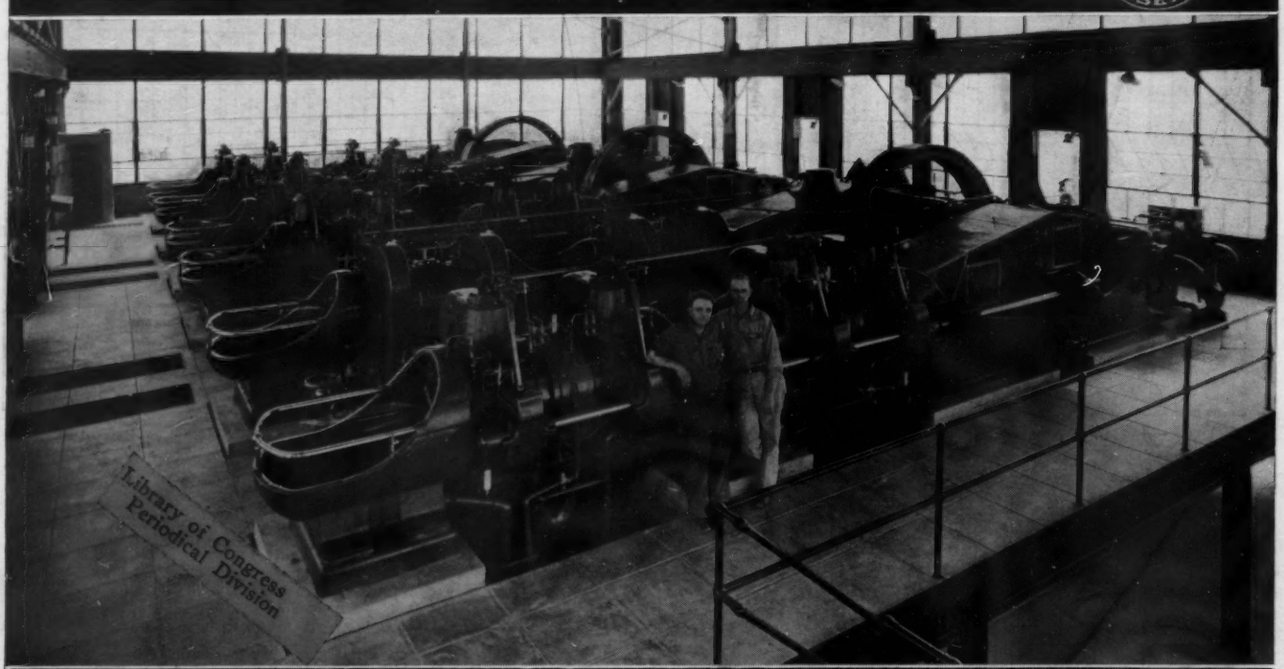
"Proven Protection for Pipe Lines"

Wailes Dove-Hermiston Corporation

17 Battery Place, New York

Philadelphia	Cleveland	San Francisco	Los Angeles	Chicago
401 N. Broad St.	Union Trust Bldg.	345 Vermont Street	2461 E. 8th Street	20 N. Wacker Drive

11 New Twins for WESTERN GAS COMPANY



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Three Cooper-Bessemer units rated 780 B.H.P. at 180 r. p. m. in compressor station near Fort Bliss, Texas

ELEVEN direct-driven compressors will send New Mexico gas to Arizona and Mexico at high pressure. All engines are twin-tandem, double-acting. Three of the stations contain three units apiece; the fourth has a pair. Each station can be expanded to hold eight units. What stronger testimony could a gas company give to the engineering excellence of Cooper-Bessemers?

Cooper-Bessemer TYPE 19's

THE COOPER-BESSEMER CORPORATION
MOUNT VERNON, OHIO GROVE CITY, PENNSYLVANIA
201 East First St. Tulsa, Oklahoma | 1313 Magnolia Bldg. Dallas, Texas | 640 East 61st St. Los Angeles, California | Suite No. 301, 25 W. 43rd St. New York, N. Y.
BRANCH OFFICES IN ALL PRINCIPAL OIL FIELDS